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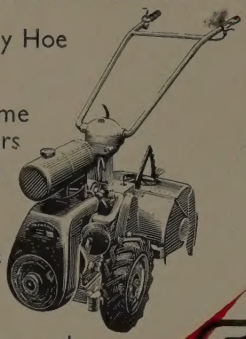

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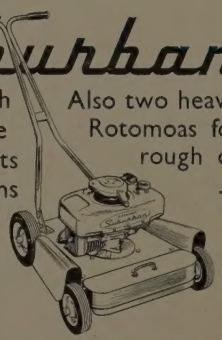

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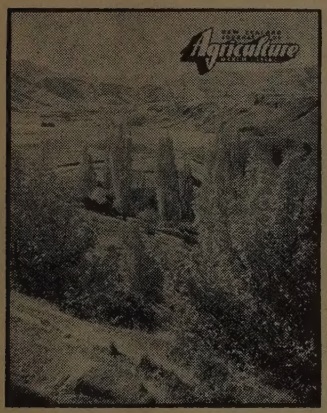
Minister of Agriculture

This Month's Cover



The country to the east of Queenstown viewed from the lower part of the road to Skippers and the Coronet Peak ski fields is the subject of this month's cover. It has been reproduced from a colour photograph by R. V. Francis Smith. The road leading through the centre of the picture is the one from Queenstown through Arthur's Point to Arrowtown. The valley, slopes, and ice-shorn ridges shown, which form part of the Arrow Basin, are very fertile as a result of a greyish, stony, glacial deposit by the Kawarau branch of the great Wakatipu glacier of former times. This deposit extends as high as Crown Terrace (in the distance at right), which is 3000ft. above sea level and 2000ft. above Lake Wakatipu. Intensive cultivation and some irrigation make this area fairly highly productive.

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The "Journal" is issued monthly. The subscription within New Zealand is 10s. a year; the overseas subscription is 13s. (sterling). The "Journal" may be ordered from any bookseller or newsagent, or direct from any office of the Department of Agriculture. Individual copies are available from Publications Section, P.O. Box 2298, Wellington, at 1s. a copy, post free.

Subscription inquiries (preferably accompanied by the address cut from a recent "Journal" wrapper) should be sent to the nearest office of the Department of Agriculture.

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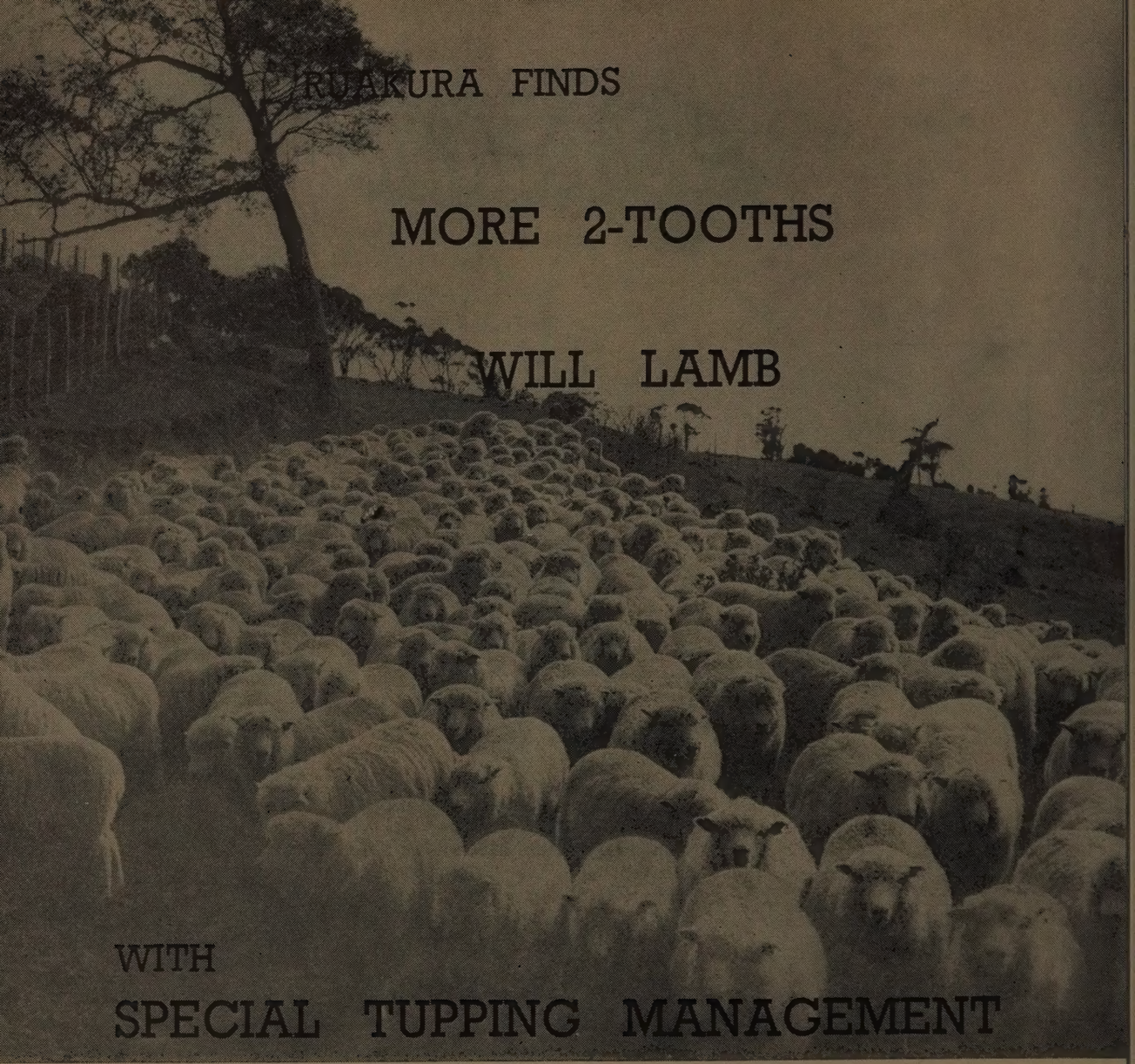
All correspondence relating to the "Journal" should be addressed to the Editor, "The New Zealand Journal of Agriculture", P.O. Box 2298, Wellington.

REGISTERED AT THE G.P.O., WELLINGTON, AS A MAGAZINE

2 3 APR 1956



RUAKURA FINDS

MORE 2-TOOTHS WILL LAMB WITH SPECIAL TUPPING MANAGEMENT

[*National Publicity*

MANY aspects of fertility in sheep are under close and continuous study at the Department of Agriculture's Animal Research Station at Ruakura. This article by I. J. Inkster, Research Officer, and L. J. Lambourne, Biochemist, both of the Station, deals with one particular aspect of this problem, the number of ewes which each year fail to breed a lamb. During recent years the authors have made detailed observations during the mating season on flocks of mixed-age breeding ewes under both fat lamb and hill country conditions. These observations have shown that a surprisingly large number of normal, fertile 2-tooths may fail to lamb simply because they are not tupped. Under conditions typical of much of the hill country breeding areas in New Zealand the number of 2-tooths which are not "settled" can be greatly reduced by running 2-tooths separately in small, easy paddocks for tupping, and by frequent mobbing up. With older ewes these precautions are unnecessary. A few 2-tooths have abnormalities which make them permanently sterile. Many more will mate and conceive if given the right conditions, but may be late or dry unless some care is taken to ensure that they are found by the ram.

Sexual Cycle in Ewe

WITH the onset of the breeding season in the early autumn ewes begin to experience at intervals of about 16 to 17 days periods of heat during which they will accept service from a ram. From studies of sheep in pens it has been shown that this heat period lasts between 20 and 30 hours and that an egg is shed from the ewe's ovary towards the end of the period. For a ewe to conceive she must be served by a vigorous and fertile ram just before or just after ovulation. Obviously the chances of this occurring are affected considerably by the duration and intensity of her heat period.

Though much is known of the behaviour of a ewe when confined in a pen with a ram, surprisingly little is known about the mating behaviour of sheep under flock conditions.

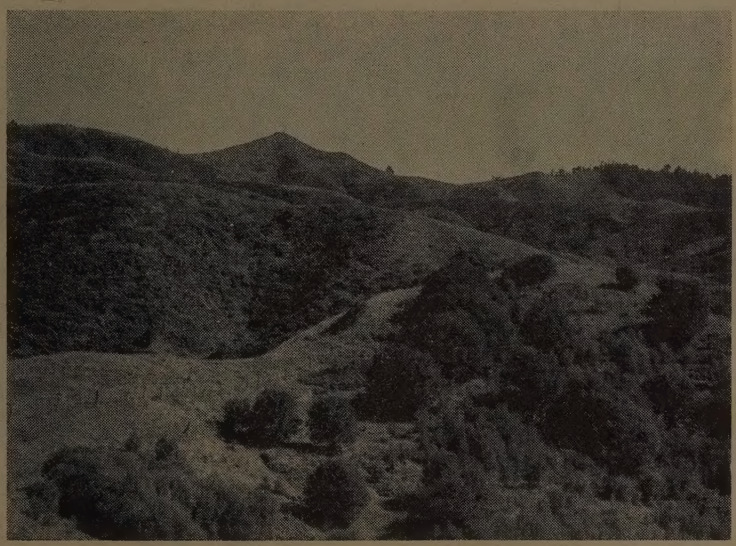
Observations at Ruakura

Continuous field observations on the mating behaviour of ewes and rams throughout the day and night have revealed some extremely interesting facts. First, though older ewes were mated at intervals throughout a period averaging 15-20 hours, it was found that 2-tooth ewes apparently had only a very short heat period, often of only 2 to 8 hours' duration. In this extremely short mating period 2-tooths were tupped only once or twice whereas adult ewes were tupped 4 to 8 times, usually by several rams. Second, distinct differences in behaviour were noted, for, though older ewes followed the rams and competed for their attention, 2-tooth ewes had to be found by the rams and had to be teased for a considerable time before they would stand and accept service. These facts were recorded under ideal tupping conditions in small, easy paddocks with 3 to 4 per cent. of rams.

What chance has the shy 2-tooth ewe of being served at the right time under the rougher conditions of hill country, where there may be areas of fern, scrub, and bush and where ridges may be separated by difficult gullies or creeks?

Field Trials at Hill Station

Over the past 2 years an experiment has been conducted at the Ruakura Hill Station to determine how the management of ewes over the tupping season can affect the percentage of ewes which get in lamb. One group of 150 mixed-age ewes (called the extensive group) was run in a very broken paddock of 105 acres with six rams and left completely undisturbed during tupping. The same number of similar ewes (called the intensive flock) was run in small paddocks of easy contour, also with six rams, but the flock was mustered into a corner and held for 5 or 10 minutes every day. The rams were interchanged between the groups every fortnight. After tupping the two flocks were combined and run together.



These views show parts of the Ruakura Hill Station which are typical of millions of acres of North Island hills. Older ewes can be run with the ram in quite broken country without any special attention.

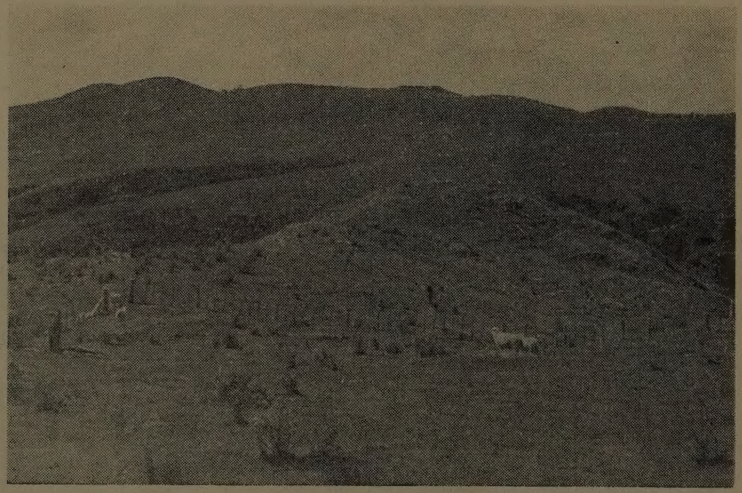
The treatments did not have any effect on the lambing performance of the **older ewes** in each group, but, as shown in Table 1, there were striking differences in both seasons between the percentages of 2-tooths which were dry in each group.

TABLE 1—THE EFFECT OF MANAGEMENT ON THE NUMBER OF EWES DRY

	Percentage of dry 2-tooth ewes	
	1954	1955
Intensive group ..	25.6	28.8
Extensive group ..	44.4	51.9

The percentage of dry 2-tooths was almost halved by the management imposed on the intensive flock, and in both years the average lambing date

Most farms, like the Ruakura Hill Station shown above, have small paddocks such as those shown below which have been cleared, cultivated, and sown in good grass. These make ideal tupping paddocks for 2-tooths, and the frequent mobbing-up recommended provides a handy training run for a young dog.



of this flock was earlier than that of the extensive flock. There appeared, then, to have been no advantage in mobbing up and tupping in small paddocks so far as the older ewes were concerned, but this type of management certainly ensured that more 2-tooths were found and served by the rams, and that they were "settled" earlier.

These results suggest the following system of management during tupping:—

1. Run 2-tooths as a separate mob in handy paddocks through which shepherds ride regularly.
2. Run the older ewes in the bigger and rougher paddocks.
3. Mob up the 2-tooths to the ram at least once a day.
4. Make doubly sure that the rams put to the 2-tooths are fertile and vigorous.

These studies have shown that a little care with the 2-tooths each day will be handsomely rewarded. The effort involved will probably effect a much greater gain than a similar effort expended at lambing time.

Radio Broadcasts

RADIO broadcasts to farmers will be given in April as follows:—

1YZ Rotorua, 7.15 p.m.

12 April—"Care of the Ewe Flock", by D. Stevens, Livestock Instructor, Department of Agriculture, Rotorua.

26 April—"Autumn, Winter, and Spring Management of Lucerne in the Rotorua District", by C. R. Taylor, Instructor in Agriculture, Department of Agriculture, Rotorua.

3YA Christchurch, 12.20 p.m.

16 April—Review of "The New Zealand Journal of Agriculture", by E. G. Smith, Instructor in Agriculture, Department of Agriculture, Rangiora.

1XH Hamilton, Mondays at 12.33 p.m. and Tuesdays at 8 p.m. (Frankton stock market report), Wednesdays at 12.33 p.m. (report from Ruakura Animal Research Station), Thursdays at 12.33 p.m., Fridays at 8 p.m. (stock sale review).

1XN Whangarei, Mondays at 8.5 p.m., Wednesdays at 8.1 p.m. (Northland stock market report), Fridays at 8.1 p.m.

1YA Auckland, Mondays, Tuesdays, Wednesdays, Thursdays, Fridays, 7.45 p.m., and Saturdays at 6 p.m.

1YZ Rotorua, Mondays at 12.33 p.m. (Waikato stock market review), Tuesdays at 7 p.m. (Hamilton stock market report), Wednesdays at 7.15 p.m. (Pig Council talk on fourth Wednesday of every other month), Thursdays at 12.33 p.m. and 7.15 p.m. (fortnightly).

2XA Wanganui, Wednesdays at 8 p.m. (Wanganui stock sale report), Thursdays at 8 p.m.

2XG Gisborne, Tuesdays at 8 p.m., Fridays at 8.2 p.m. (Gisborne stock market report).

2XN Nelson, Thursdays at 8 p.m.

2XP New Plymouth, Thursdays at 8.1 p.m.

2YA Wellington, Mondays at 7.15 p.m., Thursdays at 12.33 p.m., Fridays at 7 p.m. (Feilding stock market report).

2YZ Napier, Tuesdays at 12.12 p.m. (Hawke's Bay orchardist session), Tuesdays at 7.10 p.m., Wednesdays at 7.15 p.m. (Hawke's Bay-Poverty Bay livestock market report), Thursdays at 12.33 p.m.

2ZA Palmerston North, Mondays at 12.33 p.m., Fridays at 8.45 p.m. (Feilding stock market report).

3XC Timaru, Mondays at 8 p.m. (Pleasant Point stock market report), Tuesdays (fortnightly) at 8 p.m. (Temuka stock market report), Wednesdays at 8 p.m., and Saturdays at 10.30 a.m.

3YA Christchurch, Mondays at 12.20 p.m., Wednesdays at 7.15 p.m. (Addington stock market report), Thursdays at 12.33 p.m. and 7.15 p.m.

3YZ Greymouth, Mondays and Thursdays at 12.33 p.m.

4YA Dunedin, Mondays at 12.33 p.m., Wednesdays at 7 p.m. (Burnside stock market report), Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.33 p.m., Tuesdays at 7 p.m.

Show Dates

THE following are dates and venues of A. and P. shows up to the end of April:—

2 April—Mackenzie County A. and P. at Fairlie.

2 April—Strath-Taieri A. and P. at Middlemarch.

7 April—Oxford A. and P. at Oxford.

14 April—Malvern A. and P. at Sheffield.

Work in the Home Garden

WITH the prospect for the next two months of progressive reduction in the hours of daylight and lowering of temperatures, seed sowing during April should be kept to a minimum, and though some planting out is necessary in most home gardens, only suitably hardened, well-developed plants should be set out in situations of favourable aspect where the soil is well drained. In this article A. G. Kennelly, Horticultural Instructor, Department of Agriculture, Dunedin, discusses work in the vegetable garden in April.

FEW kinds of vegetables should be sown in the open during April, even in favourable districts, though hardy, quick-maturing vegetables such as spinach and turnips can be sown in most favourably situated, well-drained soils that are not too cold. Vegetables such as cabbages, cauliflowers, silver beet, and lettuces can be set out in most districts, but seed should be sown only if the soil is well drained and fertile and the aspect and situation are favourable.

Celery should be blanched as described in last month's home garden notes and leeks should be earthed up as they develop if long, blanched stems are wanted. In some districts a sowing of peas can be made toward the end of the month in well-drained soil and in most districts broad beans can be sown, preferably toward the end of the month.

Ground should be cleared and dug over as each crop is finished and refuse put on the compost heap or dug in. If the ground is not wanted for several months, a green crop should be sown. Seed of crops such as lupins or mustard can be sown where temperatures are not too low. Elsewhere crops such as oats or barley can be sown.

The season of good growth for tender and half-hardy crops such as marrows, pumpkins, cucumbers, and tomatoes is finished, though steady growth can be expected from hardy plants such as those of the cabbage family, leeks, silver beet, and spinach. The harvesting and storing of crops such as onions, kumaras, pumpkin, marrow, and squash should be completed before low-temperature or frost damage occurs. Low temperatures should be avoided for kumaras if they are to be stored, and frost is liable to damage and affect the keeping quality of subjects such as pumpkins, marrows, squash, and even onions.

Asparagus top growth should not be cut until the foliage begins to turn yellow, as while the tops are green the plants are building reserves of food in the crowns which will assist in the development of strong spear growth for cutting next spring. If cutting is deferred too long, seed may ripen and fall and the young plants which come up the following season may become established to the detriment of the bed. Fern growth can be cut with hedge shears which have notched blades or with a sharp knife and the bed can be weeded afterward if necessary. Top growth is sometimes left to dry and then burnt on the bed, but it is better to put it on the compost heap.

Carrots

Where winters are mild enough for autumn-sown carrots to succeed, a sowing should be made, preferably early in the month. Seed should be sown as advised in last month's "Journal".

Celery

Blanching of celery can be begun or if it is to be done in stages, can be proceeded with as advised last month. In districts where a favourable growth period can still be expected, self-blanching celery can usually be improved after the blanching material has been put in position by being watered with sulphate of ammonia or nitrate of soda at about 1oz. to 2 gallons of water. This usually

Heading photograph by Green and Hahn.

[*Sparrow*

Asparagus fern growth can be cut down when it begins to turn yellow.

stimulates growth, causing elongation of the heart and leaf stems and improving texture.

Regular spraying with a suitable fungicide such as captan, dithane, dichlone, or other suitable Government-certified fungicide should not be neglected, as celery leaf spot disease spreads rapidly in the moist conditions which usually prevail in late autumn.

Potatoes

Most potato crops should be mature or nearly mature by the end of April. Though it is not advisable to dig potatoes for long keeping until they are mature, digging should not be deferred if they have reached maturity. Potatoes can be tested for maturity by digging one or two plants. The skins of mature tubers do not rub off easily and are not readily scarred or bruised in handling.

Potato tubers form on rhizomes and are, morphologically, modified storage stems, each with its axis or centre line greatly shortened; its eyes are weakly developed lateral or side shoots. The storage stems develop from the main stem above the seed piece and on some varieties are very short, so that the tubers that develop on them are close to the seed piece; other varieties develop longer storage stems and the tubers develop further from the seed piece.

This has some bearing on the type of cultivation that should be practised, though the presence of roots in the soil is the principal limiting factor to depth of cultivation. The true roots of the potato differ from the storage stems, on which the tubers develop, and may be very extensive, growing under good conditions 3ft. to 4ft. laterally or vertically, though the main root area is usually in the upper 10in. to 12in. of soil round the parent tuber.

The development of tubers is the result of a stop in terminal growth of the rhizomatous stems on which the tubers develop, with consequent side or lateral development of the storage tissues, and the potato plant though usually classed as an annual herbaceous plant, thus seems in its nomenclature something of a contradiction in terms. It may be classed as a potential perennial because of the way it reproduces itself.

The number of tubers borne by a potato plant varies with the variety and cropping conditions and may range from 1 to about 30. All tubers set at about the same time, but it should be realised in harvesting potatoes that size of tubers is not necessarily indicative of age, as all tubers do not necessarily develop at the same rate.

Subject to Many Diseases

With the exception of tomatoes—a related crop—under glass, potatoes are subject to more disease than almost any other crop. Apart from diseases caused by deficiencies or unbalance of essential elements in the soil and by organisms such as virus, bacteria, or fungi, potatoes are subject to many physiological and environmental troubles.

One of the commonest troubles is due to the fungous disease *Corticium* or black scurf, and it may be manifest in several ways. The resting stage of *Corticium* disease can readily be recognised by the black spots or scurf which range in size from 1/16in. to ¼in. and which can readily be levered off the tuber with the fingernail. In the black scurf stage the disease is merely a blemish on the tubers, but

when infected tubers are planted the scurf develops and attacks the young shoots, usually near the growing points.

Low temperatures favour the disease and in late spring when the shoots emerge slowly many are killed or the growing points are destroyed before they reach the ground surface. The damaged shoots may branch below the injury and result in a late plant or, if the attack is severe, a miss in the row. Old sets dug up usually have a number of half-grown shoots coming from the eyes.

Injury is not confined to the young shoots, but under conditions favourable to the fungus, healthy stems are attacked later just below ground level, and the conducting vessels are invaded by the fungus, which interferes with the transmission of sap coming from the roots to the leaves and of sugars passing down to the developing tubers. The leaves may wilt in hot weather and sugars manufactured in them cannot reach the tubers in the soil, so the reaction of the plant is to form small potatoes round the stem at ground level or half way up the stem in the axils of the leaves. These tubers seldom develop to more than seed size and usually the result is top growth and no properly developed potatoes.

The fungus may be carried on nearly all tubers and can also live in the ground, but with rotational cropping, allowing a spell of about 4 years between successive potato crops, the fungus usually dies out in the soil. The black scurf on the seed can be destroyed by the use of disinfectants, such as formalin or corrosive sublimate, but this is rarely considered worth while in the home garden.

Apart from long rotations and the use of clean seed, measures to combat the disease should include planting only when the soil has warmed and been adequately manured, so as to stimulate the plants into early growth.

Storage

After they are fully mature, potato tubers normally have a 6 to 10 week rest period, during which they will not sprout. Then for a time only the end bud will sprout. Potato eyes are spirally arranged and a little later the next two or three end buds will sprout and finally sprouts will arise from all the eyes.

Tubers do not usually suffer damage, if for table use, if stored at temperatures 3 to 4 degrees below freezing. At temperatures of up to about 7 degrees above freezing they keep well if humidity is suitably maintained as respiration is reduced, but if the tubers are to be used for seed, higher storage temperatures are desirable or yields may be affected. If tubers for seed are kept at a minimum of 40 degrees F., yield is not likely to be reduced, but sprouting is likely to occur at higher temperatures after the rest period.

[*Sparrow*

Mature potato tubers should be dug if disease is likely to attack them.

Spinach

Though spinach is usually one of the first subjects for early spring sowing, it is also a useful vegetable for late autumn sowing. It withstands frost or freezing conditions better than most vegetables when established under cool conditions and it can be sown throughout winter in most districts in well-cultivated soil that is not heavy, provided the seedlings get established.

Spinach is generally rated highly as a health-giving vegetable and is quick growing, maturing under favourable conditions in from about 40 to 55 days. It will grow at temperatures only slightly above freezing, though the optimum growth temperature is somewhat higher. Though seed germinates at relatively low temperatures, seedling emergence is usually delayed where there is frequent heavy rain.

Spinach is usually classified according to whether the seed is round or prickly and most seedsmen still sell spinach mainly as either prickly seeded or round seeded, though it is preferable to buy named varieties, irrespective of seed type, suited to specific purposes. Prickly seeded spinach is usually sold for winter use, as it is generally considered hardier and more long standing than round seeded. This belief in the superiority of prickly seeded spinach is not supported by the evidence of trials of different varieties of the two kinds, as it has been clearly demonstrated that there are long- and short-standing varieties of both round and prickly seeded spinach. Either may be smooth or savoy (crumpled) leafed.

The habit of bolting to seed, which is an inherent factor present to a greater or less degree in all varieties of spinach, is encouraged by long days and high temperatures and for this reason summer sowing of even the relatively long-standing varieties is not advisable in certain districts. Even the most heat-tolerant varieties will not germinate and grow well in hot, dry weather. When excessively high temperatures are maintained for some time the edges of the leaves, particularly of the older ones, turn yellow. Continuing high temperatures result in the whole leaf turning yellow and the plant is then likely to die of rot or collar disease.

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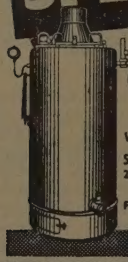

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[*Sparrow*

Spinach (above) or spinach beet is among the most useful of winter crops.

Soil Conditions

Spinach thrives in cool conditions and in a great range of moist, rich, well-cultivated, and well-drained soils. It is not tolerant of high soil acidity and lime should be applied to most soils that have not been dressed recently, though too much may cause yellowing because of a deficiency or unbalance of certain essential elements such as manganese or iron.

A good dressing of organic material such as well-rotted farmyard manure or compost supplemented by a complete fertiliser at 1½oz. to 3oz. per square yard is advisable on many gardens. As spinach is a leafy vegetable, extra nitrogen may be supplied by liquid manure or a side dressing of nitrate of soda or sulphate of ammonia raked in along the line of row. Liquid manure is preferable where conditions are inclined to be dry, as abundant moisture is essential for high yields and good quality; growth should be reasonably quick, as otherwise some varieties tend to be tough.

Seed should be sown thinly ½in. to 1in. deep in rows 12in. apart. Plants can be thinned to 4in. to 5in. apart in the row, though if seed is sown thinly, very little thinning may be necessary.

The virus disease mosaic sometimes causes reduction in yield. The first symptoms appear on the youngest leaves as numerous, fairly large, golden yellow flecks, accompanied by crinkling. In a few days yellowing becomes general over the leaf. Older leaves wither at the tips, become yellow, and die. In a few weeks the plant is reduced to a small, stunted rosette of much-crinkled leaves. Infected plants should be destroyed.

Aphides are probably the most active agents in spreading mosaic, which may be carried over from one season to the next in plants of crops such as silver beet, spinach, and beetroot. Aphides should be controlled by regular spraying with nicotine sulphate or HETP.

Spring Cabbage

Cabbage for spring use can be set out from early autumn until midwinter or even late winter, depending on climate and variety. April is the favoured month in most districts, because if good plants are set out then, they usually overwinter well and mature in spring, early or late according to growing conditions.

If set out too early, plants may make soft growth and be damaged by winter weather. If set out very late, they may be late in maturing or if conditions are severe, the crop may fail owing to disease or premature seed development, because the plants have not had time to become established before temperatures fall. Cabbages planted too late in autumn may not mature earlier and may be less satisfactory than plants set out in late winter or early spring.

Manures

The soil for spring cabbage should be rich in organic matter and in most home garden soils a dressing of organic manure such as farmyard manure, stable manure, or compost or a moderate dressing of fowl manure is likely to give best results. If the soil has not been limed recently and there is a risk of its being acid, a dressing of 3oz. to 4oz. of carbonate of lime per square yard is advisable. Heavier dressings may be necessary on some soils in high-rainfall districts.

As the effectiveness of lime is in direct relation to the closeness of its contact to the soil particles, it is best applied some time before planting. Distribution and incorporation by forking over should be as even as possible. Thoroughness of distribution is important, because there is little or no sideways spread of lime in the soil after it is applied, though its downward spread is assured by the leaching action of rain-water.

Though the manurial needs of cabbages are heavy, care should be taken to distribute fertilisers or manures evenly, as young plants may be checked if the roots come in contact with too heavy concentrations of

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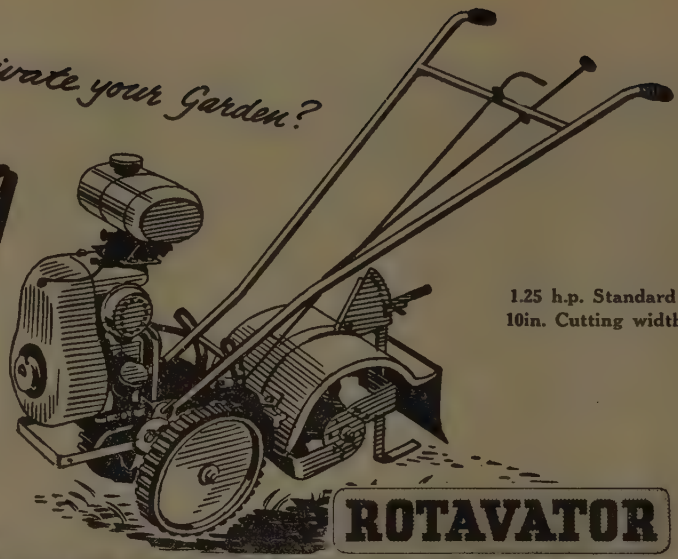

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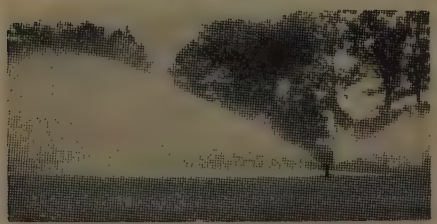

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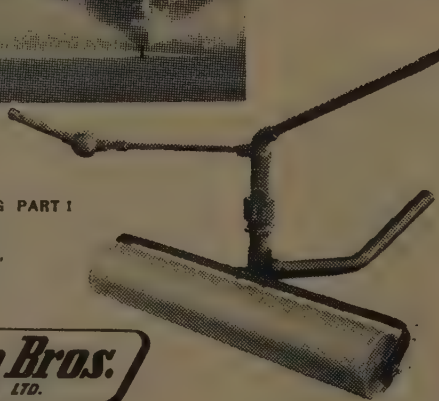

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[*Green and Hahn*

Well-rooted pointed or spring-type cabbage plants set out in good soil in April should provide good heads for cutting in spring.

manure, particularly at a time when low temperatures limit growth. Where organic manures are not available a green crop should be dug in and except where the soil is very rich the organic manure or green crop should be supplemented by a complete fertiliser at about 2oz. to 5oz. per square yard.

In addition side dressings of nitrogenous manures such as nitrate of soda or sulphate of ammonia are often advisable, particularly where organic matter applied to the soil is strawy rather than sappy and well rotted and when quick, forced growth is required (as when temperatures rise in early spring).

Varieties

There are many good varieties of pointed or spring-type cabbage, but Flower of Spring is probably the best for the greatest range of conditions. Triumph has also given good results in many districts.

Spring Cauliflower

Cauliflowers have similar needs to cabbage, but are more sensitive to adverse conditions and if checked, they are likely to button (form only miniature heads). Frost damages the curds and may permit the entry of soft-rot organisms. Cauliflowers should therefore be planted out only in districts or situations where winter conditions are not very severe. In unfavourable situations planting is often deferred until late July, August, or even September.

Hardy varieties of cauliflower suitable for planting now include All Seasons (All Year Round), Walcheren, and Early London. Plants are obtainable from most seedsmen.

Sweet Potatoes or Kumaras

Sweet potatoes or kumaras are not related to ordinary potatoes but belong to the convolvulaceae or Morning Glory family. The sweet potato is a very important crop in many tropical and sub-tropical countries and is a perennial, though in New Zealand it is treated as an annual because winter temperatures are too low for it to grow during winter or, if the tubers are exposed, even to survive.

Most varieties need at least 4 months of frost-free, warm, preferably sunny weather. Most of the nights as well as the days should be mild or warm or the yield is not likely to be satisfactory. Climatic conditions in New Zealand are often at best barely up to the optimum needed. For that reason home gardeners who grow kumaras usually leave the main crop to develop as long as possible, as the tubers gain rapidly in total yield as the plants approach maturity and the table quality of mature tubers is better than that of immature ones.

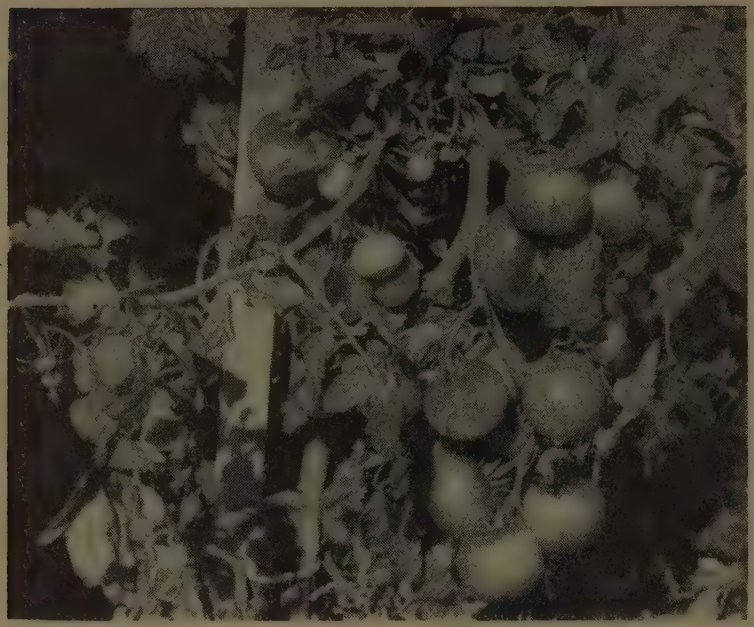
However, where tubers are to be stored digging should be completed before there is risk of low-temperature injury. Even if tubers are not intended for storage and an unusually early frost kills the tops, they should be removed promptly, as rots develop in the foliage and sometimes penetrate the tubers. The maturity or readiness of the tuberous roots of kumaras for digging is indicated by the condition of broken flesh. When tubers are mature a cut or broken surface on them dries on exposure to the air, whereas a break on the surface of an immature tuber stays moist and usually turns a dark colour.

If the quality of stored tubers is to remain at its best from one harvest until the next, they must be handled with care. Badly damaged ones should be rejected and the remainder subjected to a period of fairly high temperature and humidity to cure them and enable wounds to heal. They should then be stored in conditions of scrupulous cleanliness at a temperature of not less than 50 degrees F.

Tomatoes

Frost is usual in many districts in April and though different varieties of tomatoes vary in their resistance to frost—most varieties withstand several degrees and a few withstand more—no variety grows well if subjected to low temperatures. Fruit likely to be damaged by frost should therefore be gathered and stored or the plants should be covered at night.

Where frost is not yet likely to be heavy the thickest masses of leaves can be trimmed off to facilitate the movement of air to speed drying and reduce humidity, which tends to encourage disease. Leaf trimming is usually justified at this time of year, when growth is nearing its end, though severe early defoliation is not advisable, because the leaves have the essential function of elaborating the foods which are used in building the plants and the crops they carry.



[*Green and Hahn*

Vine-ripened tomatoes are best, but fruit should be gathered and ripened artificially where there is risk of frost damage.

Several stages of maturity are recognised in harvesting tomatoes: First, the immature green stage, then the mature green stage of fully developed fruit, then the turning stage (when the mature green fruit takes on at least in part a whitish or very light pink or yellow tinge), then the half-ripe or pink stage, and finally the ripe or red-ripe stage.

Ripening of Fruits

Fruits harvested at the immature stage may not be fully grown and never develop the quality of vine-ripened fruit. They are often tough and are usually of poor colour when ripened artificially. Mature green fruit develops good colour only if ripened under favourable conditions. Fruit picked at the turning or half-ripe stages can be satisfactorily ripened under the conditions available in most home gardens. Quality of green fruit ripened at room temperature has been shown in some experimental work to be inferior to that of fruit picked when at the turning stage. Analysis of green, turning, and vine-ripened fruit has shown that the ratio of sugars to acid was highest in the vine-ripened fruit with progressive decline in the fruit picked at the turning and the green stages.

The home gardener, whose aim is storage combined with ripening, can hold tomatoes picked at mature green or more mature stages at 60 degrees F. and they will ripen satisfactorily. Most varieties of tomatoes ripen best at temperatures above 55 degrees F. Some experimental work indicates that most varieties decay rapidly when ripened at 70 degrees if they have been held at temperatures below 49 degrees for longer than 2 weeks. Most green tomatoes can be kept for about a month at 50 to 60 degrees and sound, firm, ripe tomatoes can be kept for 10 to 12 days at 40 degrees. Humidity in storage should be high (95 to 98 per cent.) to prevent shrinkage. Regular picking over every 2 or 3 days to remove fruits likely to develop rots is very important.

Home gardeners often expose picked fruit to the sun under glass to colour and ripen, but that treatment is usually advisable only with fruit that is nearly ripe, as less mature fruit will become soft and rubbery before it ripens. Sound green fruit that is dry and reasonably mature, though not coloured, can be packed in boxes stacked one on top of the other in a shed, or the fruit can be wrapped individually in paper or stacked in a box with material such as clean straw or a double layer of scrim between each layer. Mature fruit ripens fairly well if the plant bearing it is pulled up by the roots and hung in a shed where the air is fairly moist. Favourable temperature but not light is necessary for ripening stored fruit; strong sunlight may be a disadvantage, as it may damage tissue by burning or shrivelling it.

Careers in Agricultural Extension Work

THOUGH advisory work among farmers is the main function of the Extension Division of the Department of Agriculture, there are many supporting activities which offer interesting possibilities to the young person seeking a career in agriculture.

For carrying out field experiments on the division's research stations research officers are required. This is interesting work for those with an inquiring mind and who are careful and methodical in their approach to new problems. Soil conservators are needed for the study of soil erosion and for soil conservation surveys. Other specialists deal with farm management investigations, farm machinery, irrigation, and seed production. The study of agriculture up to the B.Agr.Sc. degree standard is desirable for those desiring to take up special lines of work or for general extension work in the Department.

At the research stations chemists are required to study the chemical and physical properties of soils and the chemistry of crops and plants. Soil analyses are now being used increasingly by extension officers in their diagnosis of soil problems and these analyses are carried out by chemists at central laboratories. Soil chemists are required to possess qualifications up to the standard of B.Sc. degree, with chemistry as a major subject.

Technicians

Supporting the research officers in the field and the chemists in the laboratory are technicians who carry out the details of the research programmes. Technicians must be thoroughly reliable, as so much depends on the accurary of their work of weighing or measuring. Technicians are usually recruited as technical trainees from boys and girls leaving secondary schools with school certificate or university entrance, though there are sometimes openings for technicians on field work for those possessing a Diploma in Agriculture. Some of these officers, after experience on field experimental work, who show an aptitude for developing the necessary requirements may ultimately progress to undertake extension work as Fields Instructors. Alternatively there are prospects for technicians to advance to the more responsible positions of Technical Officers.

Details of careers which can be followed in agriculture are obtainable from the nearest office of the Department of Agriculture or from the Staff Training Officer, Department of Agriculture, P.O. Box 2298, Wellington.

Adequate Winter Feeding Essential in

Control of Milk Fever, Acidosis, and Grass Staggers

OVER the past few years there has been a considerable increase in the incidence of metabolic diseases in many dairying districts, with consequent stock losses and decreased production. The blame is frequently attributed to the so-called adverse effects on stock health of high-producing pastures and attempts have even been made to dissuade farmers from embarking on any pasture improvement programme because of the reputed harmful effects on stock health of such pastures. In this article V. E. Senior, Veterinarian, and A. V. Allo, Instructor in Agriculture, both of the Department of Agriculture, Tauranga, discuss the incidence of metabolic diseases in dairy stock and offer suggestions on how their incidence can be reduced. Essential to the winter feeding programme they recommend are the high-quality pastures sometimes blamed for incidence of the diseases by those in search of a culprit.

THE group of diseases generally referred to as metabolic diseases are milk fever, acidosis, and grass staggers. All are common in spring and though it is recognised that some animals are prone to attacks of milk fever and will succumb to the diseases regardless of nutrition, there seems to be little doubt that the occurrence of disease can be reduced by adequate and balanced feeding.

Acidosis

The name metabolic implies some interference with the breaking down of ingested food or failure to build up the breakdown products of digestion into a utilisable substance, so that a toxic by-product is produced and acidosis or acetonemia develops. The latter condition can occur before, at time of, or up to some weeks after calving and under diverse conditions. Either pregnancy or lactation appears to be the only constant requirement, the aggravating factor being poor or unbalanced feeding.

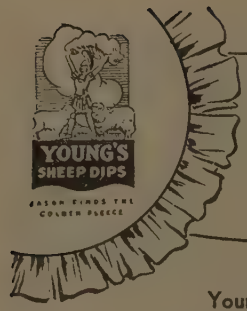
In countries where cattle are housed during winter acidosis often occurs in apparently well-fed animals receiving a ration of grain with straw instead of hay or roughage. In Canada it is not unusual to find 50 per cent. of a herd giving a positive test for urine acetone. Treatment involves the use of carbohydrate injections, and cod liver oil may also be of value. However, in Canada, quickest recovery was obtained when the herd was given a bite of green grass, recovery usually taking place within a day or two of this treatment.

In New Zealand acidosis occurs under vastly different circumstances, but the essential features of the condition are similar, with malnutrition or unbalanced nutrition the basic cause. Inco-ordination of gait, staggering, and a "stupid" appearance in a dry cow due to calve shortly are often due to acidosis, and the condition can frequently be corrected by giving the animal access to an area of autumn-saved pasture. There can be few diseases for which more remedies have been tried, most being aimed at supplying a readily assimilable form of carbohydrate. Of these, glycerine appears to be the most popular and normally gives good results.

Milk Fever

The condition known as milk fever is not really a fever at all, the temperature of the animal being subnormal. It is associated with a lowering of the calcium content of the blood and often appears in stock the nutrition of which seems to be satisfactory. This drop in blood calcium bears no relation whatever to the actual amount of calcium either in the body or in the diet of the animal and it is useless attempting to control the

▼ Winter crop of chou moellier being break fed to a herd.



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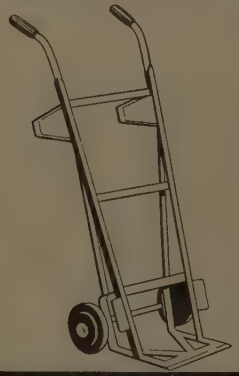

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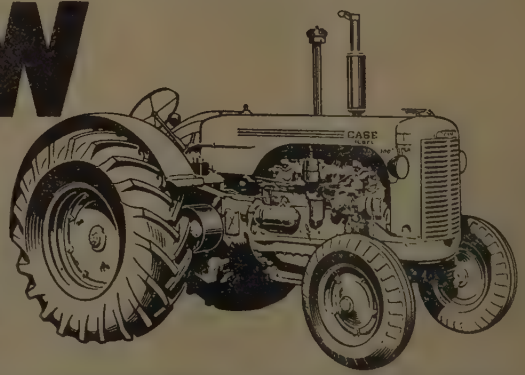

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Herd feeding on break of autumn-saved pasture in July. It is significant that farmers who are able to give their cows access to good grass before calving tend to have the least metabolic trouble with their stock in spring.

disease by liming the pastures or by drenching with limewater.

Associated with the fall in blood calcium is a drop in blood phosphorus. Green, at a conference on grassland and animal health in Great Britain in 1948, stated: "Milk fever can occur in spite of superabundance of calcium and phosphorus in the food and can be treated therapeutically without change of diet by an injection of calcium alone in amounts quite trivial in comparison with the much larger daily food intake of the element or the enormous, easily-available skeletal reserves."

The effect of calcium injection is merely to return the blood calcium level to normal long enough to allow the mechanism controlling blood calcium to jump back into gear.

In western Canada the milk fever season coincides with the late spring and early summer rains, which stimulate the rapid growth of fresh, young grass. It is not unusual to see the spring and normal calving season pass without a single case of milk fever, in spite of the fact that many animals are producing heavily on a grain diet with straw and hay. The fact that these selfsame animals go down with milk fever after rain has encouraged growth of fresh, young grass is hardly accounted for by the small increase in milk flow which results from eating this grass. Indeed, Canadian experience appears to confirm the opinion of the writers that milk fever is, to some extent anyway, associated with a sudden change of diet and not necessarily only with calving and lactation.

Grass Staggers

Grass staggers is a metabolic disease that can kill with a speed and efficiency that leaves little time for speculation as to the best type of treatment to adopt. It occurs in animals with low blood magnesium, the onset of symptoms being precipitated by factors not yet clearly understood. However, short, protein-rich pastures, calving, and spells of cold weather all appear to be suspect. The relationship between protein-rich food and grass staggers was emphasised by J. C. Gerring in his article "Grass Staggers in Beef and Dairy Cows" in the December 1954 issue of "The New Zealand Journal of Agriculture", and there is now ample proof that a diet containing too much protein and insufficient carbohydrate, particularly during cold, rough weather, will act as a precipitating factor.

The Norwegians state that when a sudden demand by the body for extra carbohydrate is not met a rapid drop in the magnesium content of the blood occurs. Carbohydrate is supplied by mature autumn-saved grass, by hay, silage, and roots, but not by young, protein-rich grass, and, experimentally as well as in practice, the condition can be controlled by balanced feeding, particularly during July, August, and September, when lactation and feed scarcity go hand in hand. Treatment of grass staggers involves the injection of magnesium either into the bloodstream or subcutaneously and, provided it is done promptly, recovery is usual. Speedy treatment is difficult in the severe type of staggers frequent in beef breeding cows.

Diseases Can Co-exist

The problem of metabolic diseases is complicated by the fact that the three conditions of acidosis, milk fever, and grass staggers can co-exist in an animal to a degree not always assessable by visual examination. Though the picture of the recumbant cow with head turned toward the flank may be typical of milk fever, acidosis or magnesium deficiency may be present at the same time and retard recovery. The use of a composite injection containing calcium, dextrose, and magnesium is gaining in popularity and the inclusion of phosphorus in the mixture would also seem to have scientific merit, as biochemists have established a relationship between the elements calcium and phosphorus and their utilisation by the body. All three metabolic diseases are associated with the lowering of the content of either calcium, carbohydrate, or magnesium in the blood and enough has been said to indicate that this condition is to a large extent bound up with the nutrition of the cow before and after calving.

Critical Period

During the last few weeks of pregnancy the foetus makes heavy demand on the system of the cow. When winter feeding is adequate she will be able to satisfy the demands both of herself and her unborn calf without undue trouble. If, however, feed is short, she will nourish the calf at the expense of her own constitution. As a result, many inadequately fed cows calve in poor condition. After calving, they are normally put on to autumn-saved pasture, often supplemented with silage saved for this time of the year.

This change from a low to a high plane of nutrition, coupled with the normal strain of parturition, throws the physiological mechanism out of gear and metabolic upsets may occur. The high producers in the herd are frequently worst affected, which is

Hay and silage used for wintering of cows should be of good quality and should be fed in adequate amounts.

only to be expected when the facts given are considered. Because the trouble normally shows up after calving when the cows are put on to better-class paddocks, it is easy to understand how the belief has developed that these diseases are associated with high-producing pastures. Actually, most of the fundamental damage has been done before calving and before the cow has access to this grass.

Improper Winter Feeding

As a result of their observations in the field the writers are of the opinion that metabolic diseases are largely the consequence of improper winter feeding, either the feeding of too little fodder or a fodder of a very low feed value. Only too often herds of cows are being wintered on completely bared pastures and given only a few pounds daily of hay of variable quality. Again, cows may be wintered on both hay and silage but be fed far less of these materials than they require.

That the quality of winter feed is every bit as important as quantity is not sufficiently appreciated. Much of the hay fed in winter to cows is coarse and fibrous, lacks clovers, and is difficult to digest. Cows will not winter well on this material, even if it is fed to capacity, and it is easy to appreciate the shock to the cow's system when she is suddenly transferred after the strain of calving from this constipating class of fodder on to high-quality, easily digested autumn-saved pasture. The wonder is not so much that metabolic diseases occur, but that they are not far more widespread in many districts.

Preventive Programme

In attempting to combat metabolic diseases, then, the first essential is to feed stock adequately over winter on a high-quality fodder, particularly over the last few weeks of pregnancy. Of all feeds available grass is the most suitable, and it is rather significant that farmers who are able to give their cows access to good grass before calving tend to have the least metabolic trouble with their stock in spring.

Consequently, any planning by a farmer to combat metabolic diseases must be done many months before his cows calve. First he should be sure that he has adequate supplies of good-quality winter feed, either hay, silage, or a crop. Cows will winter well on swedes, chou moellier, or soft turnips, provided they have access to hay or silage and a crop of soft turnips sown in early March will be available for feeding off in June or July. That the importance of a winter crop is being fully appreciated by many farmers is seen in the increasing acreage sown to winter crops in many dairying districts.

It is essential also to increase greatly the area of autumn-saved pastures on most farms. In the Auckland Province up to two-thirds of the farm should be shut up for this purpose, closing being done from early April to early May. Early feeding out should be done on the balance of the farm, which should have been closed up in March to allow the grass to get away before the cows are let in. During April, May, and early June cows should be wintered on this area, being given liberal supplements. During this period the 60 per cent. of the farm closed for autumn-saved pasture is getting away. By the middle of June the earlier closed pastures will be ready for grazing and can be lightly grazed off by the herd, with the use of the electric fence, the grass being supplemented with hay and silage if it is still available.

If cows are wintered as outlined, they are on a steadily rising plane of nutrition and should be in good condition for calving. After calving they will be able to come into production with less chance of their going down with metabolic disease.

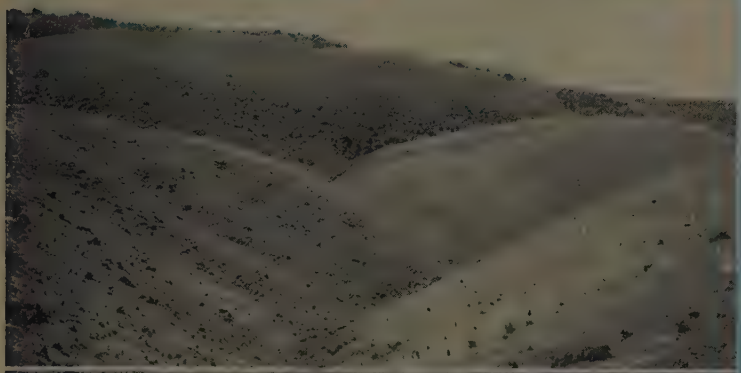
Of course, for such a system to work it is essential that the paddocks closed for autumn-saved pasture should contain adequate quantities of pasture species such as short-rotation and perennial ryegrass and cocksfoot, species capable of growing over winter. It is useless to expect good autumn-saved pasture from sodbound paspalum pastures or areas consisting of only low-producing species. For pastures closed over winter fertility must be sufficiently high to enable the grasses to grow into winter.

In other words, for the system of winter stock management recommended to succeed, high-quality pastures are essential. Far from being the cause of metabolic disease the higher-quality strains of pasture plants, if used wisely, actually can be the most valuable weapon the farmer has in control of the diseases.

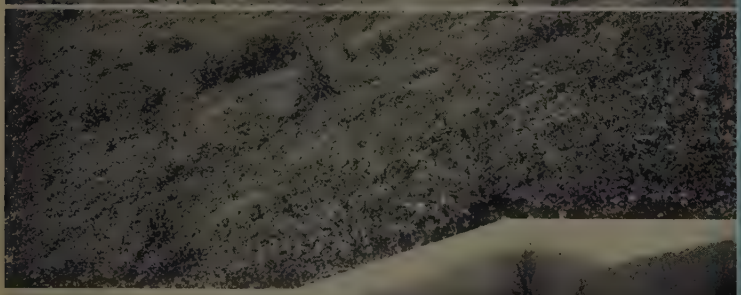
Land Development Aided by Aircraft

ON the large State land development projects in the Rotorua-Taupo district the Department of Lands and Survey has made considerable use of aircraft to topdress and sow areas which were difficult to handle by other methods. During the 2 years ended 30 June 1955, 50,700 acres were topdressed and 14,500 acres sown to grass by this method on the blocks in this district.

A Loading seed to be spread on a State development block in the Taupo district.



← Areas of steep country at Rotomahana sown by aircraft in 1952. The scrub was burnt inside a previously prepared firebreak and the seed was then spread from the air, this being followed by aerial application of fertiliser. A standard pasture mixture of 30lb. per acre was spread by a Tiger Moth from an altitude between 70ft. and 100ft. in calm weather.

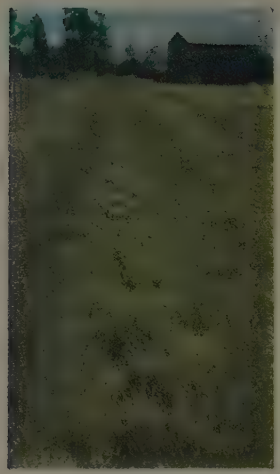


Pasture sown by aircraft at Rotomahana and indicating the even spread. For sowing areas up to 200 acres from the air by light aircraft the calm conditions ← which often exist in this district 2 to 3 hours after daybreak and 2 hours before nightfall are necessary. However, larger areas can be handled successfully in a moderate wind, provided it is steady from one direction.

Besides its use as a means of sowing pasture on steep and broken country, the aeroplane is also useful to spread seed on flat land where there are obstacles for machinery, such as stumps, logs, and trees, and also where the climate ← requires that the work be completed quickly. Here is part of such an area in the Taupo district where there are obstacles to machinery and where the winters are severe, making it necessary to get large blocks sown quickly to enable the clovers to establish before winter frosts begin.

—*C. R. TAYLOR,*
Instructor in Agriculture,
Department of Agriculture,
Rotorua

Weedkillers for Irrigation Races

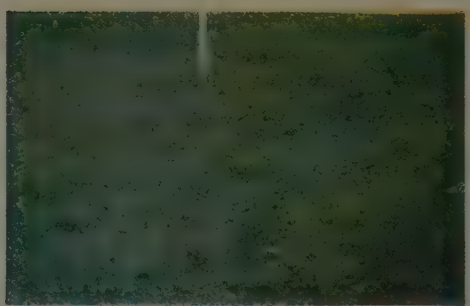


Races choked like this one with small rushes, ryegrass, flat weeds, and grassy weeds impede the flow of water, will lift water out, and lead normally to inefficient irrigation.

Left above—Poiyborchlorate is very effective and will give useful control in races infested with small rushes, thistles, flat weeds, and many grass and clover species.

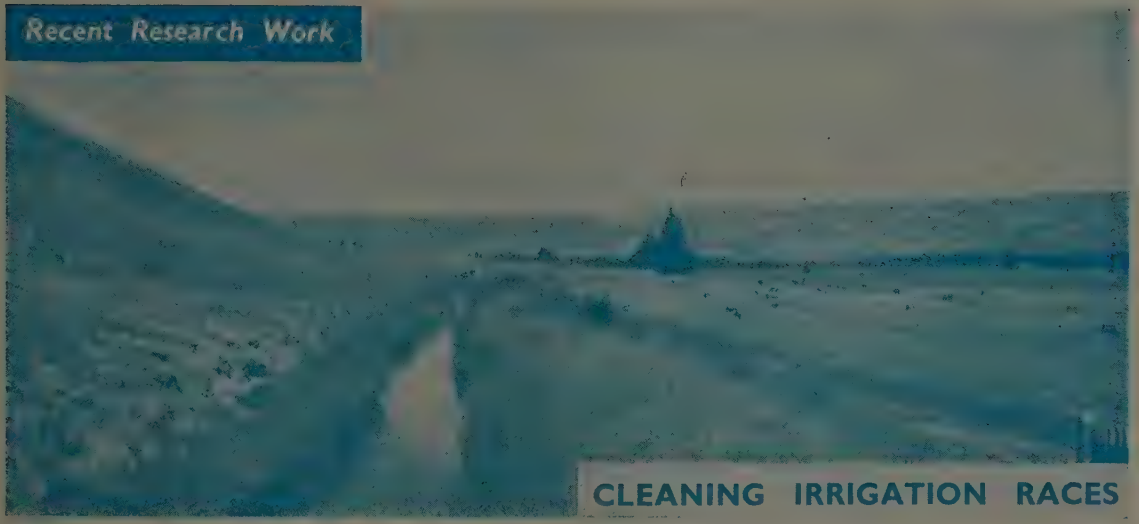
Right above—TCA is very effective for control of grass weeds.

2,4,5-T at 2lb. to 3lb. acid equivalent per acre will give complete control of tutu.



Bracken fern can be controlled by using PEG 4C at 3lb. acid equivalent per acre at the fronding stage.

Inferior weed control due to late application of weedkiller. Material should have been applied well before the irrigation season.



CLEANING IRRIGATION RACES

ON irrigated farms in Central Otago race cleaning is a very important duty and is usually performed during the off period, thereby ensuring an unimpeded flow of water during the irrigation season. Growth in races and on the banks is normally prolific and many methods are adopted to clean races. They vary from heavy stocking to the use of shovels, and occasionally flame-throwers or small motor mowers are used. A considerable amount of time and effort is expended in cleaning races and this article suggests as an alternative method the use of weedkillers.

WEEDKILLERS

THE advantage of using weedkillers lies in the fact that they are effective, easy to apply, and reduce the time spent on race cleaning to a minimum. Where water has to be brought long distances through stony country normal shovel cleaning disturbs the race bottom, leading to increased loss through seepage. The use of weedkillers eliminates this disturbance and the race seal is maintained and over a period will undoubtedly be strengthened. The illustrations on the opposite page show results obtained by the use of weedkillers in a race badly infested with small rushes, thistles, flat weeds, and many grass and clover species. The weedkillers used were TCA, "Polyborchlorate", and CMU applied at the beginning of August. In the control of tutu and bracken fern respectively 2,4,5-T and PEG 4C were used.

CMU AND "POLYBORCHLORATE"

CMU at 25lb., 50lb., and 75lb. per acre does not give very satisfactory control under these circumstances owing mainly to the time of application. Under low rainfall CMU acts very slowly. If it is used for cleaning irrigation races, sufficient time must elapse for the CMU to become effective before the water is turned on; otherwise the CMU is so insoluble that it is washed away and poor weed control results. Quicker acting contact chemicals such as borate/chlorate mixtures are probably more suitable. These chemicals are not wholly dependent on rainfall for activation and may be applied 4 to 6 weeks before the water is turned on. Rates from 300lb. to 600lb. per acre are usually sufficient to control most grass weeds and check broad-leaved weeds such as Californian thistle.

TCA

TCA at up to 100lb. per acre has proved very effective for clearing grass weeds out of races. The effect of TCA is quick and excellent control is given for a full season. This material is very useful, but it checks thistles only temporarily. For grassy weeds, which form the bulk of the problem associated with cleaning, it is invaluable.

SECONDARY WEEDS

There are problems associated with the weedkillers used, especially when a complete kill is required. Subsequent invasion by thistles and flat weeds is inevitable, but follow-up spraying with 2,4-D formulations later in the season offers no difficulties in controlling secondary weed invasion. On steep sidelings care is necessary to ensure that the lower shoulder of the race is not completely denuded of plant material, because this may lead to a break in the race from stock activity or water pressure and seepage where race walls are thin.

TUTU AND FERN

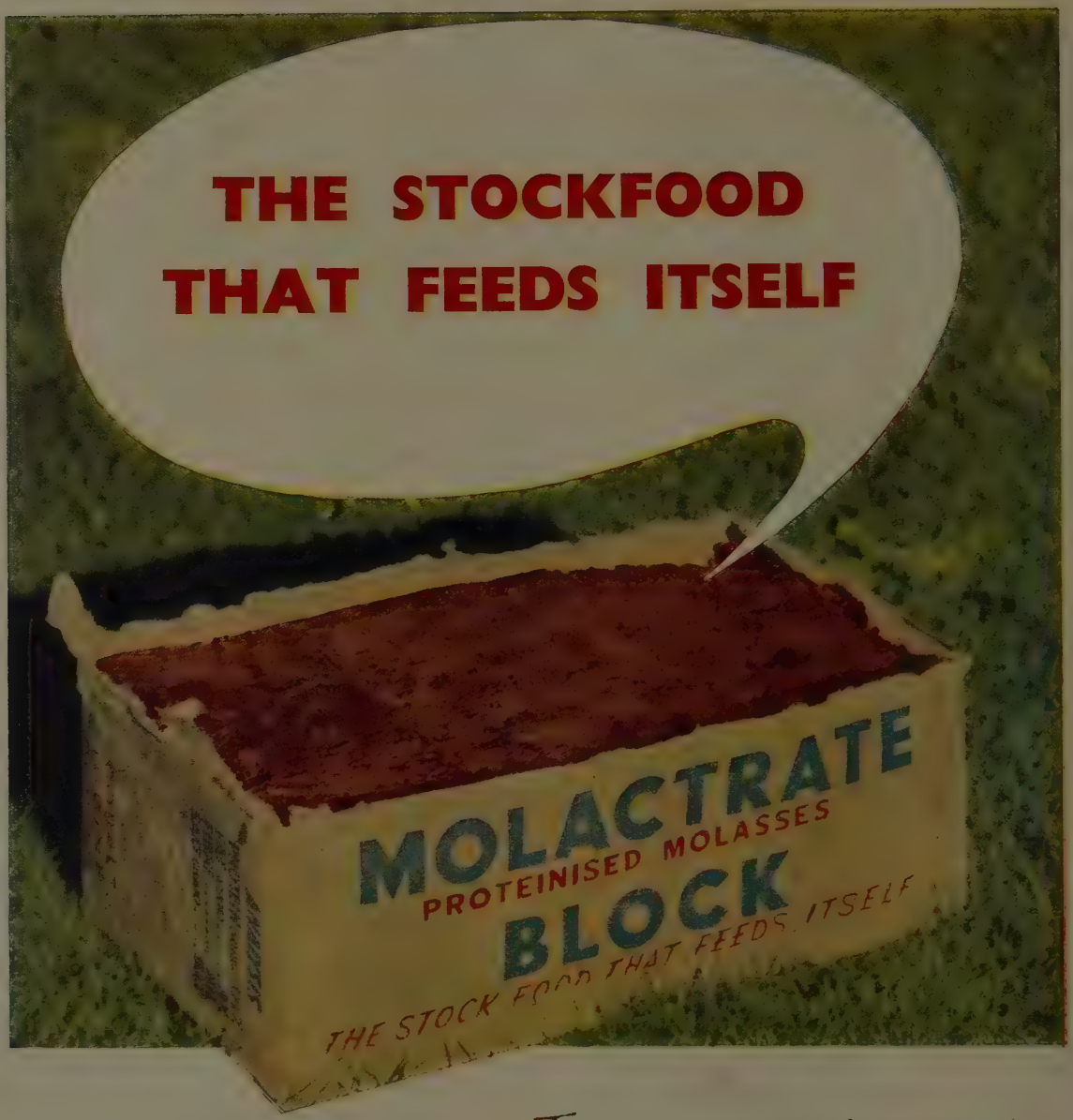
Frequently irrigators have the problem of controlling tutu and bracken fern, particularly in races round hillsides, which are often miles long. One of the greatest difficulties with this type of country is access to repair a break in the race. A race crossing a hillside is a receptacle for anything slipping down the slope above it and blockages are frequent. Choking weed growth aggravates such trouble, and clean races are therefore essential. Tutu is killed with volatile forms of 2,4,5-T at 2lb. to 3lb. acid equivalent per acre. Spraying at berry formation gives complete control. Bracken fern also creates access difficulties and can cause blockages and loss of water. PEG 4C at 3lb. acid equivalent per acre will give control at the fronding stage. The problem with bracken fern is that fronds do not make simultaneous growth and repeat sprayings are therefore essential to cover the period of fronding. It is best to delay spraying until most of the fronds are breaking out into true foliage. In this way the majority are caught with the first spray. Subsequent sprayings may then consist more or less of spot sprayings where needed as indicated by frond development.

NEW CHEMICALS

Quantities of weedkiller to use cannot be stated definitely, as race conditions vary considerably from farm to farm, but if the quantities already indicated are used as a guide race cleaning can become relatively easy. Furthermore, many new chemicals such as "Dalapon", boron compounds, and "Chlorea" may prove more promising for specific weed control in races other than those mentioned.

—R. C. SCHOFIELD

THE STOCKFOOD THAT FEEDS ITSELF



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Class of Bird to Buy for

Constant Supply of Eggs from Household Poultry

A BIRD during its first year of production is known as a pullet and during the second laying season as a first-year hen. When the householder has overlooked the ordering of pullets to replace all or part of a flock, he faces difficulties at this time of the year in purchasing pullets near to production. It may then be necessary to retain birds for another season and additional first-year birds may have to be purchased to replace those which died or were culled during the pullet years. The disadvantage of a flock containing only first-year hens or older birds is that during the moulting period few, if any, eggs can be expected for 10 to 12 weeks. This unfortunately coincides with the season when eggs are short and consequently dearer. In this article H. H. Watson, Poultry Instructor, Department of Agriculture, Wellington, discusses the desirability of having a greater proportion of pullets than hens to obtain a constant supply of eggs throughout the season.

MANY householders disregard the cost of producing eggs and appear quite content if an adequate supply of fresh eggs is available for everyday use. Others expect birds to lay continuously, overlooking that birds have an annual moult at the end of the laying season about February or March. The moulting period may extend for 12 weeks, during which only a very few eggs can be expected. If fresh eggs are required during this period, the flock owner must have pullets coming into production when the last season's birds are beginning to moult. Pullets which have been hatched at the right time of the chick season will achieve this aim.

Heavy-breed birds (Australorps, Rhode Island Reds, and cross-breeds) should be hatched during August, and light breeds such as White Leghorns may be September hatchings. Under average conditions light breeds take 5 months to mature, and heavy breeds take 6 months. Chicks that have been hatched from mid-October onward take longer and often are 8 to 9 months old before they begin to lay. Therefore these birds may not be in production until well into winter.

Order Well in Advance of Requirements

The householder who has planned carefully to have a constant supply of eggs throughout the year should aim to have pullets comprising at least two-thirds of his flock. Pullets just laying or coming into production at this time of the year must be August or September hatched, depending on breed. Chicks hatched during June and July will begin laying about Christmas and pullets from these very early hatches are not recommended for the householder, as generally hens still in production will have to be disposed of to make room for them. In addition, early-hatched pullets are often subject to a partial or neck moult during March or April. This results in a drop in production of up to 6 weeks.

Pullets can be bought at any age, from a day old until near lay, and delivery can be given by commercial men to suit requirements. Many householders prefer to buy their pullets at the perching stage, when the birds are 6 to 8 weeks of age. This saves them the worry of rearing young chicks. However, others choose to take delivery of pullets at the point of production, and when accommodation is limited this system has its merits. Hens can be retained until a short time before the pullets arrive. The fowlhouse can then be cleaned thoroughly and disinfected and the new birds introduced.

The price of pullets varies according to age. Those near to lay cost from £1 to 30s. each, depending on quality of stock and locality.

Unless pullets have been ordered well in advance of requirements, there is a risk of the purchaser having the choice of accepting culls or late-hatched birds, these being hatched from mid-October onward. At present these may be of any age between 3 and 8 months. Many such birds have been rejected by the breeder, as he considers them unlikely to develop into first-grade layers. When these birds are kept in large lots by the farmer they would be bullied by their stronger flock mates and so would never be profitable to retain commercially. However, these birds when purchased in small lots and kept on their own sometimes prove to be quite satisfactory layers. A farmer normally

A poorly grown, 16-week-old pullet showing slow feathering, often characteristic of late-hatched birds.

Reminders for April

A GOOD depth of litter should be built up in the laying shed at this time of year before the damper conditions which come with the approach of winter. Where long straw is used this will be gradually broken down by the birds and sufficient should be added during autumn to ensure at least 3in. to 4in. of broken-down straw on the floor for winter. Cleaning out of litter in winter is very undesirable, as new straw tends to become damp and to mat during winter, when the air is laden with moisture.

Dry wood shavings are excellent material to mix in with straw as litter in a house for laying pullets.

When pullets first come into lay it is quite common for a few eggs to be laid by birds at night while on the perches. This need not worry the householder, as this practice usually lessens or disappears as the birds come into normal and steady production. Some of the eggs laid at night on the perches are soft shelled or without shells. This does not necessarily indicate wrong feeding; it is quite common among pullets coming into lay.

Even if pullets are receiving fish oil in their mash or pellets containing vitamins, they should receive a daily ration of good greenfeed. This greenfeed is necessary to get good colour in the yolks.

If pullets have not been dewormed with carbon tetrachloride, each bird should be given a 2 c.c. capsule. This is a worthwhile safeguard against worm infestation.

BUYING BIRDS FOR HOUSEHOLD POULTRY FLOCK

Birds of various breeds and ages are sent to auction marts and even though they are caged in small lots, they are not always graded according to their possible laying ability.

disposes of this class of stock through the auction marts and only the unwise farmer would sell this grade to a household poultry keeper.

The buying of culls or late-hatched pullets is inadvisable and if a purchaser has no other choice, he should receive them at a reduced price. Such birds may take several weeks or even months to lay, which means only a few eggs are produced when the price is high. it is far more economical to purchase good, healthy, near-to-lay pullets at a higher price than culls or late pullets at a reduced price. Pullets which reach maturity within a normal period will lay more eggs during their first laying season than in any subsequent season. For example, birds which lay 160 eggs during the pullet year will produce 2 to 3 dozen fewer during the second season and this rate of decline continues as the birds become older. To retain laying birds more than two seasons is not economic.

First-year Hens

When the householder is unable to buy good pullets near to laying and has an option of purchasing only late or cull pullets, it is usually better to purchase first-year hens from a dependable source. In such circumstances he would be wise to visit a commercial farmer and explain the class of bird required. If the farmer is told what is wanted, the choice may be left to him, because if he values his reputation and wants customers to return year after year, he will select high-quality stock.

First-year hens may cost less than half the price of pullets and though they have to be carried through the moult, they are often back into production at about the same time as cull or late pullets begin to lay. Even though hens do not lay as many eggs as can usually be expected from pullets, they lay larger eggs. With average, healthy hens there will be fewer losses than among pullets.

The purchase of birds from auction marts is not recommended to those looking for laying stock. The markets are used by farmers mainly as a means of disposing of cull birds most of which are suitable only for table purposes. Even when suitable laying birds reach the market, they are usually not graded for this purpose.

The householder who keeps only first-year hens in his flock must be prepared to be without his own supply of fresh eggs from mid-March until after mid-June. Production will then increase gradually and a constant supply of eggs will be available until the following autumn. These birds will more than pay their way, but should be disposed of at the end of their second laying season.

Photographs by Niederer.

EDITOR: A. G. G. HILL

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2. Animal Output of Reseeded Grassland. Part II - - - J. J. Prendergast and J. J. Brady
3. Certain Pasture Variations and Their Effect Upon the Dairy Cow - - - - - - - - - - - - - R. J. Halley
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Change of Administration of Noxious Animal Destruction

RESPONSIBILITY for the destruction of noxious animals (deer, opossums, chamois, tahr, goats, pigs, wallabies, etc.) would from 1 April 1956 be transferred from the Department of Internal Affairs (Wildlife Division) to the New Zealand Forest Service, according to a recent statement by Mr. S. W. Smith, Minister in charge of both these Departments.

The Government considered that the destruction of noxious animals was more appropriately the work of the Forest Service and would be better handled by that Department, as the pests mainly inhabit the forests over which the Forest Service has control and the damage they do impairs forest management. With an area of approximately 8 million acres of native protection forest under its control the Forest Service has an obvious interest in the destruction of these pests and also has the decentralised organisation and suitable staff to strengthen the administration of the work.

The Wildlife Division would still, Mr. Smith stated, continue to be responsible for the conservation of protected birds and other species and would continue to safeguard the interests of acclimatisation societies in respect of game. The acclimatisation districts of Rotorua, Taupo, and the southern lakes would still be administered by the Division.

There was no intention at present, the Minister concluded, to change the administrative control of other wildlife functions.

▲ Extension work in New Zealand. An Instructor in Agriculture talking to farmers at a potato growing field day in North Otago.

Agricultural Extension Work

By P. W. SMALLFIELD,
Director, Extension Division, Department of Agriculture, Wellington

INTEGRATED agricultural research and advisory services are now recognised to be essential in a modern state, for during the past 40 years or so they have proved to be of prime importance in developing farming efficiency. Advancement has come about through the co-operation of farmers, advisory officers, and research workers, for though at first there was often some hesitancy among farmers to seek or accept advice, the position has now changed and advisory services are hard pressed to meet the demand for information.

IMPROVEMENT in New Zealand's services can be brought about only if farmers are fully appreciative of the problems, scope, and methods of advisory work, and it may be helpful to describe what advisory services are and how they work and are organised, and in doing so to draw on overseas as well as local experience.

Work of Advisory Services

Farm advisory services are called by several names. The term extension has gained fairly general acceptance from the prestige of the service in the United States of America which developed as extension teaching of the land-grant agricultural colleges and associated experiment stations. The names advisory and instructional place a somewhat different description on the work, but instruction often describes the nature of the work most correctly as it is carried out. Terminology is possibly not very important, except that it gives some indication of the differing approach of administrators, farmers, and field officers to the work; some incline to the phase of self-help and co-operative education and community planning, others to demands for precise information and instruction.

In practice there are three main phases of work:—

1. Making available to farmers the results of recent research and helping them to put the results into practice.

2. Widening among farmers appreciation of the general fund of knowledge of the science and practice of farming.

3. Developing local farming, homes, and communities.

The agent in this work, though he may be called an extension agent, advisory officer, or instructor, draws his authority and acceptance to work on these lines from his knowledge of local farming and local people. This can be gained only by close association of local officer and local farmers and is a thing of gradual growth. Some people react best to instruction and close guidance; others seek precise information only about some particular project they have in mind; some are keen to co-operate in community and farm planning and others are not. To be of service, extension work and programmes must be flexible to meet community and individual demands.

The Agent

The agent is essentially a "general practitioner" in the science and practice of farming and in modern states the general pre-requisite for recruitment is a bachelor's degree in agriculture. His first work in a district is to build up a fund of knowledge of local farming and to know and be known by the local people. He is not an authority on all branches of the

THE author (left) recently completed a short tour of duty overseas to study agricultural extension work in England, Scotland, and several states of the United States of America. In this article he reviews recent trends in the scope, methods, and organisation of farm advisory work.

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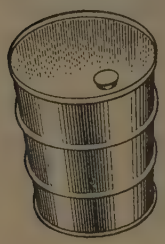

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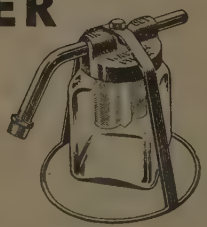

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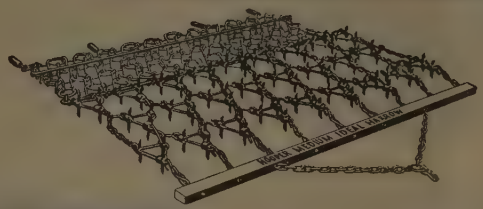

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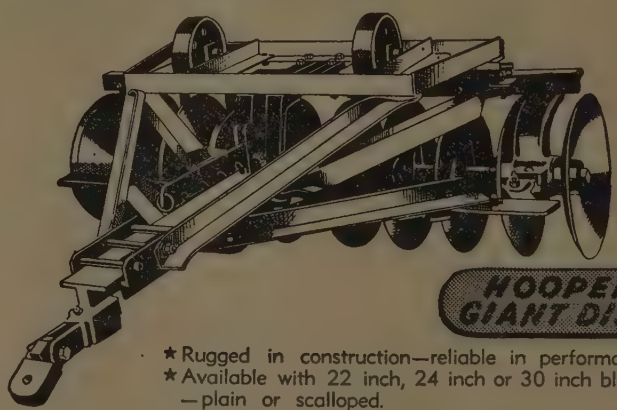

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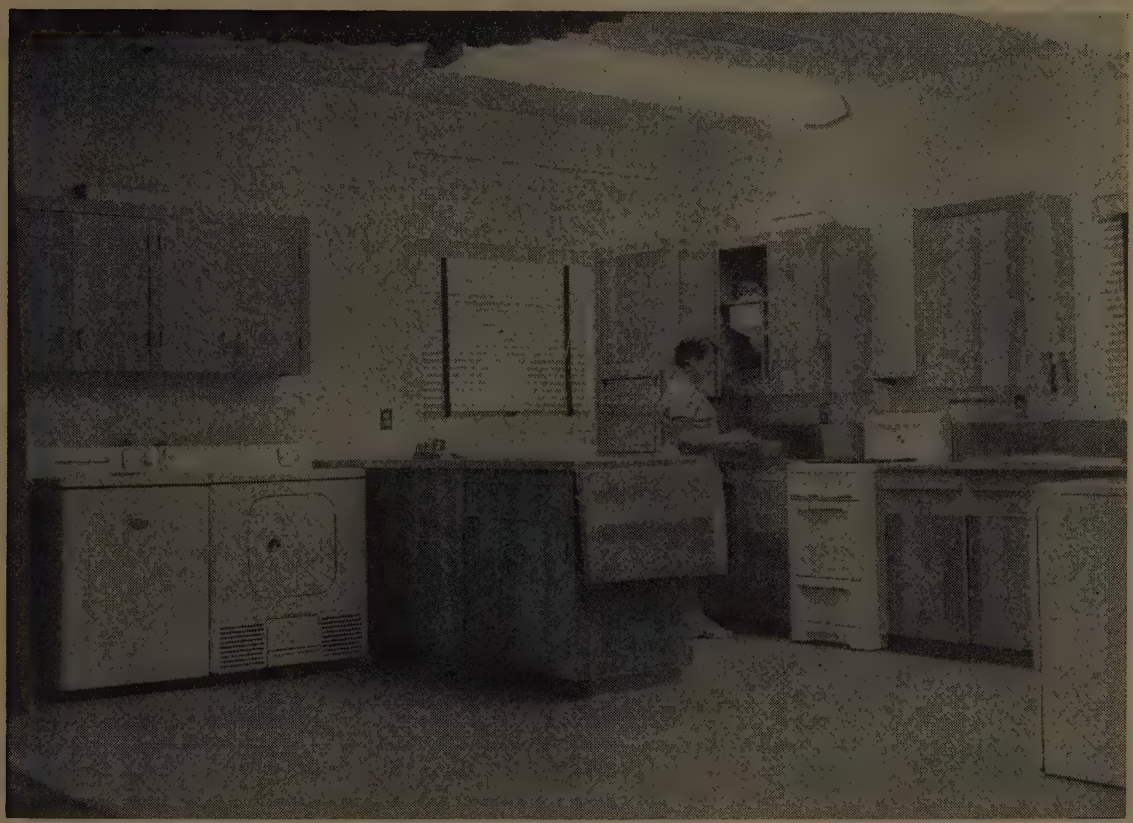

"The emphasis which is placed on improvement of farm family living in extension work in the United States is a reflection of the most valuable work which has been carried out by home demonstration agents."—Stage of extension service lecture theatre in Fresno County, California.

science and practice of farming, but he must reach the stage where he is an authority on local practices if his work is to be accepted, and this takes time. It is impossible for him unaided to keep abreast of advances in all branches of research and practice, and the general administrative organisation of his service must supply him with the necessary information.

In the earlier days of advisory services this was not difficult, but the growth of research work has necessitated the appointment of subject specialists to sort out and provide information to help the agent to carry out local trials and demonstrations and to do field advisory work in certain subjects.

Subject Specialists

With advances and specialisation in the pure sciences there have been corresponding advances and specialisation in the research fields of agriculture. The volume of research has also increased greatly in recent years, and there is now a definite place for subject specialists to keep research and extension in touch.

Generally, subject specialists cover a much wider field than that of the sectionalised research groups in the subject. For instance, there may be a number of research groups working in various fields of animal nutrition, but one subject specialist may be sufficient to provide the necessary liaison between all groups and extension officers. The employment of subject specialists to link research and extension has generally evolved as the need for the service and suitable people for the positions has arisen and consequently follows no regular pattern.

In addition, subject specialists are also required for laboratory and diagnostic services to aid extension officers and inspectors in such fields as entomology, mycology, chemistry, botany, and plant and animal pathology. These laboratory and diagnostic services are essential in the organisation of an efficient extension service, and though commonly working in close liaison with research institutions, they are generally a separate service.

With the development of specialisation in research and advances in practice there has been found a need for specialist advisory officers to supplement the work of general advisory officers in various fields of general farming. Specialists in animal husbandry are needed, for instance, where stall feeding of animals is practised, drainage and irrigation specialists where these practices are locally important, farm management officers wherever extension work has advanced to the stage where the business aspects of farming need to be reviewed, and the development in mechanisation in recent years has added machinery instructors to most advisory services. Though the "general practitioner" still remains the pivot of extension systems, his work is being extended and supplemented by subject specialists, and this appears to be a necessary and desirable process.

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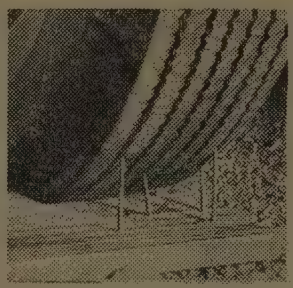

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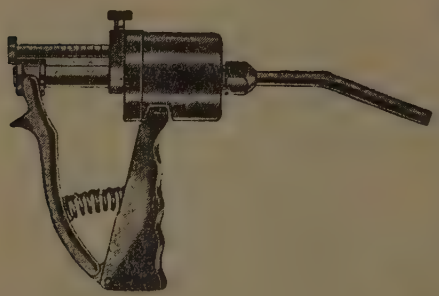

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a real problem in specialist and laboratory services if the movement grows, for ways and means will have to be found to integrate club work with necessary supporting services. At present each club at initiation has the services of an experienced adviser drawn from organised extension work, but in time lack of servicing by specialists will certainly reduce efficiency.

Research and Extension

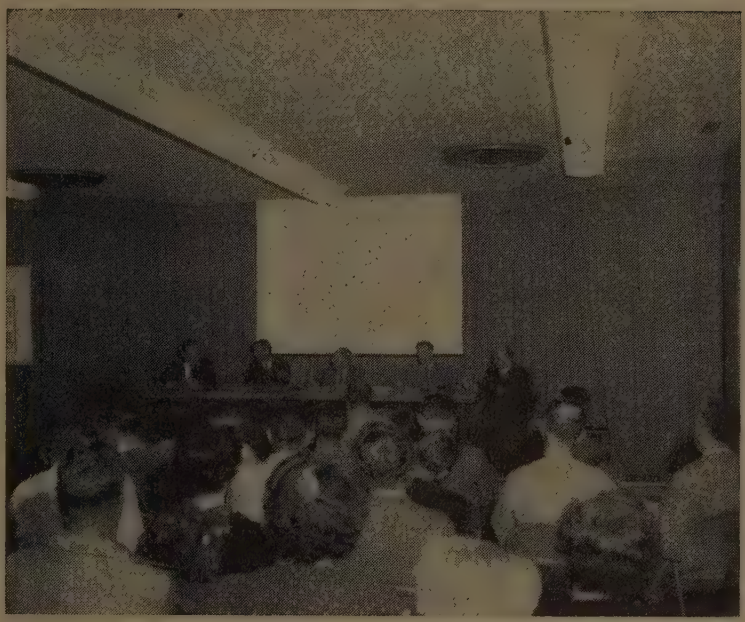
The first duty of extension workers is to make available to farmers the results of recent research work and help them to put the results into practice. There are few developments where simple propaganda suffices to spread new practices. Even developments in such things as vaccines, artificial breeding, or herd testing require organised services. Developments in soil management, particularly in the use of fertilisers and in crop and pasture production, require local investigation and repeated demonstration before they are accepted in practice, and naturally so.

The rate at which new developments are adopted into farm practice is viewed by different people in different ways. Research workers are naturally anxious to see the results of their work adopted rapidly in practice and farmers and extension workers are no less keen. However, as most developments have to be tested or demonstrated locally and when found to be efficient have to be considered from the business point of view, changes often cannot be brought about as quickly as desirable. Considering the general limitation of staff in extension services in relation to size of districts or numbers of farms, it is remarkable how quickly farmers do adopt new practices as soon as their value has been demonstrated locally.

Science and Practice

Besides diffusing and demonstrating the results of recent research work extension officers have the duty of keeping farmers, particularly young farmers, conscious of the general fund of farming knowledge, with particular emphasis on those things which are of local importance. For instance, as efficient soil management is basic to most farm improvement projects, the best practices in drainage, cultivation, and the use of fertilisers must be continually stressed and demonstrated. Similar steps must be taken with crop and pasture production and livestock and farm management.

This phase of extension work is most important with country youth organisations such as the Young Farmers' Clubs, and most extension services place great emphasis on this work. Generally the work carried out with young people is not nearly as thorough as it should be, and there is need in most countries for a wider appreciation of the value of such work to farming and to the state.



"There has been a tendency, particularly in the United States, to organise community group planning of farms, homes, and amenities . . ."—Community planning discussion group, Fresno County, California.

To develop a wider appreciation of efficient farm practices extension services generally issue bulletins on a wide range of common subjects such as drainage, irrigation, fertilisers, and production of particular crops and there is much confusion of thought regarding the value of this type of literature. Judged from the point of view of the individual farmer wanting to improve his practices, say, in maize production, a bulletin on maize growing may not be of much value. In most cases he will know and practise the directions laid down in the bulletin. What he wants may be information on the value of a new variety or a new machine, or the specific to control certain weeds. For such information he seeks the advice of his local extension officer, and accordingly most of the advice to practising farmers is verbal or contained in letters or local newspaper articles and does not appear in general farming bulletins. But these general farming bulletins have great value in stimulating interest of young farmers to learn improved practices, and a major problem is to interest a wider audience of young people in such literature.

Community Planning

To many people the normal procedures of extension through farm visits and discussions, lectures and demonstrations, articles and radio talks appear inadequate to improve farming and country living quickly and efficiently. There has been a tendency, particularly in the United States, to organise community group planning of farms, homes, and amenities, the procedure being for the local extension officer to call community groups together but to leave the onus of further detailed action to the community both individually and collectively to carry out accepted farm and home improvement plans. The basis of the idea and procedures is that an educated, democratic people should work together, seek and pool information, and need no close guidance.

Farmers' clubs, which were formed in the late 1870s and continued to the early 1880s, were probably the earliest attempts in New Zealand at community extension effort. The Cambridge club, which functioned from 1875 to 1882, was instrumental in interesting local farmers in the practice of pasture topdressing. Other important activities have been farmer competitions in pasture and crop production, fodder conservation, and, more recently, the development of farm discussion groups and farm improvement groups. None of these fulfils the American conception of community planning of farms and farm living, and it would appear that any development in this direction

here would have to arise naturally from individual and community initiative and conform to New Zealanders' way of life.

The emphasis which is placed on improvement of farm family living in extension work in the United States is a reflection of the most valuable work which has been carried out by home demonstration agents. This has as its objective the making of farm home life more efficient, more comfortable, and more attractive. This branch of farm extension work has proved its worth here and could well be expanded.

Methods of Extension Work

Methods of extension work are fairly uniform in all modern states and are based on farm visits, demonstrations, lectures, articles, radio talks, bulletins, circulars, trial plots, and short courses. The methods, procedures, and techniques for each phase of the work have been worked out by experience and are generally quite effective.

The farm visit is probably the most effective method, for the advice sought is normally in relation to a specific project or problem, and precise information can be given. It is criticised as being time consuming, but once a farm has been visited and contact established much subsequent work can be done by telephone or letter. Only through farm visits can an extension officer know and be known among the farming community.

Lectures, articles, radio talks, and bulletins serve to arouse interest and requests for farm visits. This is quite natural, for few are willing to make recommended changes in farm management without reviewing the change in relation to particular conditions.

Demonstration and trial plots are essential in extension work. Local soil fertility problems require local trials for their examination, new varieties and strains of produce plants and annual crops must be tried out in localities where they may prove useful, and most suggested changes in soil, crop, pasture, and livestock management require local demonstration before they are brought into practice. Trial and demonstration work is usually performed by extension officers working in close liaison with research stations through subject specialists.

Importance of Research and Extension

No modern state can afford to neglect agricultural research and extension. Land is limited and populations are growing, and improved efficiency in farm production is imperative. Generally New Zealand's research and extension services are efficient and compare favourably with those of other states, but increased efficiency and expansion will be necessary if primary production is to keep pace with the Dominion's increasing population and consequent increased demands for imports.

☆

Heading and Baling Straw in One Operation

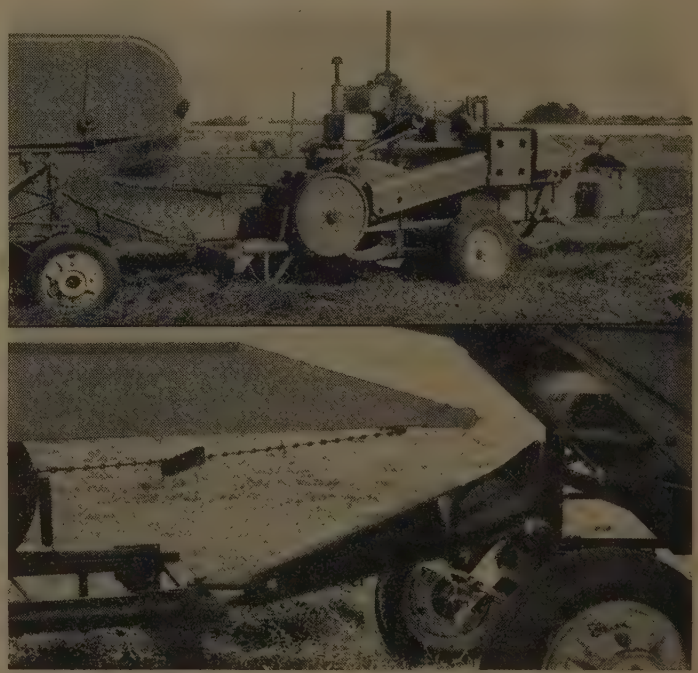
By R. INCH, Fields Instructor,
Department of Agriculture, Nelson

MR. J. ROBINSON, of Willowby, feeds a considerable amount of short-rotation ryegrass and clover straw to his sheep. He has made a practice of baling all this straw immediately after heading the crop in order to prevent spoiling by weather, but he has now constructed a tray with a conveyer belt on the baler so that both heading and baling can be carried out in one operation.

A strong arm was welded to the back of the header and the drawbar of the baler was attached as shown in the lower illustration. The conveyer tray was made long enough to catch the straw as it left the header but not so long that it would be in the way when the machine was turning corners. The conveyer in the tray shown in the lower illustration is being driven by a V belt off the pick-up shaft of the baler. Though this is shown as a single chain, this was not entirely satisfactory and has now been replaced by a double chain that, attached to the scrapers some distance apart, keeps them running parallel.

The obvious advantages of this method are the saving of labour because of the elimination of the extra tractor and driver and the baling of the straw while it is still in good order. The other advantage, not so apparent but very important, is the fact that this method saves all the valuable clover leaf that would otherwise be left on the ground.

The first time Mr. Robinson used this adaptation was to harvest red clover. He unhooked the baler and as a trial tedded and baled the straw in the usual manner. He found that he had one-third fewer bales from the same length of row and, more important, had lost most of the leaf.



Upper—The tray is attached so that it will catch all the straw, but will be out of the way when the header is turning corners. Lower—A close-up of the rear of the header, showing the arm welded to the back of the header to take the drawbar of the baler.

Tree Measurement

IN the management of a woodlot it is sometimes desirable to know the volume of timber present, or even the height only of the trees. Such information is comparatively easy to obtain if the right equipment is available—an Abney level for heights and a steel diameter tape for diameter measurements. Without them the owner must be content with somewhat less accuracy, but a near approximation can be obtained by following the procedure described here by W. H. Jolliffe, Extension Forestry Officer, New Zealand Forest Service.

Height

IT is never necessary to measure many trees for height; usually about five are sufficient provided they have been carefully chosen as representative of the stand. In some cases it will be possible to climb the trees with a 66ft. or 100ft. tape or even with one end of a ball of twine, the unrolled length to be measured on the ground afterward.

If climbing is not possible, there are two ways of ascertaining the height. One is by estimation, using a pole of known length to stand beside the tree as a guide. If a pole say 12ft. long is used, it is helpful to mark it clearly at the 4ft. and 8ft. positions. The observer should stand as far away as he can while still seeing both the pole and the tree clearly and estimate the height of the tree above the pole, using the pole and its marks for comparison.

The height of the tree is A + C where A is the distance between the observer and the tree and C is the height up the trunk at a point horizontal from the observer's eye.

The other way is by using a 45 degree triangle (half a square piece of board cut diagonally will do). To use this simple instrument hold the 45 degree angle to the eye (it can be steadied on a pole) with one of the "square" sides horizontal and walk away from the tree until the top of the tree, either the total height or the point where usable (merchantable) timber finishes, can be sighted along the diagonal side. If the ground is level, the height of the tree is the same as the distance the observer is away from the tree plus the height of his eye from the ground (see illustration). Any difference in the slope of the ground necessitates adding or subtracting an amount according to how far up the trunk or below it the sighting along the horizontal side of the triangle strikes.

Diameter

Trees are rarely truly circular in cross section and the best way to obtain an average diameter is by measuring the girth (in inches) and dividing it by 3 1/7 or by 3.14 whichever is preferred. A diameter tape gives this information on the reverse side without the need for figuring.

For the calculation of volume it is necessary to know the mid-diameter inside the bark; that is, the diameter of the woody core under the bark half way up the merchantable part of the trunk. To obtain this figure measure the diameter at breast height (4ft. 6in. from the ground) and deduct from it the thickness of the bark; add to the remainder an estimate of the diameter at the top of the merchantable trunk and divide the sum by 2, which will give the approximate mid-diameter. There is no need to make a deduction for bark in the top diameter —it is very thin in the upper part of the trunk.

Volume

The merchantable trunk of a tree has generally the shape of a cone with its top cut off. The volume of a solid so shaped is calculated by multiplying the area of the cross section half way along its length by the merchantable height.

When the mid-diameter (in inches) has been found as described the area of the cross section (in square feet) can be read from Table 1. This area when multiplied by the merchantable height (in feet) gives the volume in cubic feet.

Theoretically, 1 cub. ft. contains 12 board ft., but in the conversion of logs to timber anything from 40 to 60 per cent. (depending on the diameter of the logs) may be lost in slabs, offcuts, and sawdust. The factor used to convert cubic feet to board feet, therefore, varies from about 5 (for small logs) to about 7½ (for large logs).

Yield Table

It is often desirable to know what volume may be expected from a stand at different ages or to be able to compare the progress of any stand with some average. For this purpose the New Zealand Forest Service has compiled yield tables and one, for *Pinus radiata*, is reproduced on the next page.

Yield tables are compiled from a large number of measurements and their average nature must be stressed. The stand the reader is concerned with may differ from this average in more ways than one, but a simple approximation, detailed in the explanatory notes below the table, will give a roughly true volume for any such stand.

TABLE I—BASAL AREAS (AREAS OF CIRCLES)

Diam. (in.)	Area of circle (sq. ft.)	Diam. (in.)	Area of circle (sq. ft.)	Diam. (in.)	Area of circle (sq. ft.)
1	0.006	21	2.405	41	9.168
2	0.022	22	2.640	42	9.621
3	0.049	23	2.885	43	10.085
4	0.087	24	3.142	44	10.559
5	0.136	25	3.409	45	11.045
6	0.196	26	3.687	46	11.541
7	0.267	27	3.976	47	12.048
8	0.349	28	4.276	48	12.566
9	0.442	29	4.587	49	13.095
10	0.545	30	4.909	50	13.635
11	0.660	31	5.241	51	14.186
12	0.785	33	5.940	52	14.748
13	0.922	32	5.585	53	15.321
14	1.069	34	6.305	54	15.904
15	1.227	35	6.681	55	16.499
16	1.396	36	7.069	56	17.104
17	1.576	37	7.467	57	17.721
18	1.767	38	7.876	58	18.348
19	1.969	39	8.296	59	18.986
20	2.182	40	8.727	60	19.635

TABLE 2—YIELD TABLE FOR RADIATA PINE

Age (years)	Average top height (ft.)	Basal area per acre (sq. ft.)	Average d.b.h. (in.)	Stems per acre	Yield to 6in. top (cub. ft.)
5	18	28	2.1	1,200	—
10	36	130	4.9	1,000	170
15	57	208	8.0	600	2,340
20	79	245	11.0	370	5,140
25	99	268	13.5	270	7,740
30	111	287	15.4	220	9,640
35	118	302	17.0	192	11,000
40	123	316	18.3	173	12,000
45	127	326	19.5	157	12,900
50	130	335	20.7	143	13,500
55	133	343	21.8	132	14,200
60	134	351	22.8	124	14,700

Explanations of Headings

1. **Age** is the number of years since planting, regardless of the age of the young trees when planted.

2. **Average top height** is the average of the height of the biggest trees. For this, measure the heights of say five trees and take an average of them.

3. **Basal area** is the cross-section area of the tree at breast height (4ft. 6in. from the ground). In the third column it is expressed in square feet per acre and is obtained as follows: Measure the diameters at breast height of all live trees on a sample area and then total the equivalent areas given in the basal area table (Table 1). Then by finding the area of the sample calculate the basal area per acre.

4. **Average d.b.h.** is the diameter at breast height outside the bark of a tree with the average cross-section area.

5. **Stems per acre** is the total number of living trees to the acre. Those which fork below breast height are counted as two or more trees.

6. **Yield to 6in. top** is the volume in cubic feet per acre of all living trees above a stump height of 6in. to a top diameter of 6in. The tops of the trees are not included in this figure, but they would not yield any produce other than firewood.

If at the ages given in the first column the top height and the basal area of the stand being measured differ from those in the second and third columns, a reasonable estimate can be obtained by direct proportion. For example, if a 20-year-old woodlot has an average top height of 60ft. and a basal area of 200 sq. ft. to the acre the merchantable volume per acre is:—

$$\frac{5140}{1} \times \frac{60}{79} \times \frac{200}{245} = 3185 \text{ cub. ft.}$$

(not 5140 cub. ft. as in table).

Meteorological Records for January

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in Inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	68.5	+ 3.6	84.9	50.9	9.35	16	+ 4.85	2.41	2	153
Auckland	160	69.9	+ 3.5	83.9	59.8	2.65	9	— 0.53	1.50	7	166
Tauranga	10	68.4	+ 3.8	85.2	55.8	4.75	12	+ 0.81	2.57	8	163
Ruakura	131	67.0	+ 3.9	83.8	48.2	1.91	11	— 1.57	0.69	30	124
Rotorua	975	65.6	+ 2.8	88.8	50.1	7.10	13	+ 2.74	3.85	8	116
Gisborne	12	69.2	+ 4.4	99.8	47.5	1.27	8	— 1.27	0.61	28	225
New Plymouth	160	67.0	+ 4.8	79.8	53.5	9.05	15	+ 4.58	2.00	7	160
Karioi	2125	62.6	+ 5.6	85.0	44.0	3.34	16	— 0.34	1.15	7	
Napier	5	70.5	+ 5.0	93.9	57.7	2.09	11	— 0.52	1.16	7	190
Wanganui	72	68.9	+ 5.4	83.4	53.1	3.14	12	+ 0.36	0.78	7	185
Palmerston North	110	67.0	+ 4.6	84.0	52.7	3.46	18	+ 0.26	0.54	28	157
Waingawa	340	67.6	+ 5.2	89.1	49.5	3.16	15	+ 0.76	1.20	8	199
Wellington	415	65.0	+ 4.0	76.0	50.5	8.87	16	+ 5.79	2.18	8	179
Nelson airfield	5	65.7	+ 4.1	82.8	48.9	4.95	14	+ 2.11	1.50	6	193
Blenheim	12	67.8	+ 5.2	91.0	46.6	3.13	13	+ 1.14	1.36	29	220
Hokitika	15	63.6	+ 5.5	74.7	48.1	9.38	15	— 0.34	3.05	26	217
Hanmer	1270	66.3	+ 6.6	96.0	39.5	1.09	12	— 2.44	0.26	29	232
Christchurch	22	67.3	+ 5.9	92.1	44.6	1.12	6	— 1.11	0.37	30	228
Ashburton	323	69.5	+ 8.5	101.2	40.8	2.16	6	— 0.47	0.89	30	264
Timaru	56	67.8	+ 7.2	97.7	41.4	2.50	8	+ 0.13	1.32	29	247
Alexandra	520	70.4	+ 8.7	99.0	47.8	2.03	10	+ 0.19	0.99	29	261
Taieri	80	63.8	+ 6.0	91.7	45.1	2.45	12	+ 0.07	0.82	6	234
Invercargill airfield	0	61.5	+ 5.3	87.3	39.5	2.15	16	— 1.58	0.51	21	250
Chatham Islands	140	60.1	+ 2.8	69.7	43.2	0.94	8	— 1.84	0.30	28	

New Zealand Society of Animal Production

THE 16th annual conference of the New Zealand Society of Animal Production was held at Massey Agricultural College, Palmerston North, on 1, 2, and 3 February.

Subjects of papers at the conference included hogget ill thrift, comparison of hogget thrift on perennial ryegrass and white clover, effect of high and low plane rearing of hoggets on lifetime productivity, sheep management on improved hill pastures, New Zealand climatic production potentials of pasture plants, face cover in sheep, Cornell research on methods of selecting dairy sires, aspects of dairy sire selection, milking characteristics of identical twin cattle, early weaning of pigs, sources of loss in the unfertilised and fertilised sheep ovum, economic aspects of New Zealand's livestock industry, bloat control, 25 years of Mendelian sheep breeding, and antipyrene injection for body fat estimations in pasture grazing animals.

The memorial address, "W. J. Croucher, Father of the Pig Industry", was delivered by Dr. C. P. McMeekan, and the conference subsequently directed the executive committee to consider the publication in one volume of this and previous memorial addresses, which would be a valuable permanent record of the contributions of outstanding men to the development of New Zealand's primary industry.

"Proceedings" (papers and discussions) may be ordered from the secretary to the society, care of the Ruakura Hill Country Station, P.B., Frankton Junction.

Officers elected at the annual meeting were: President, Dr. J. P. James; vice-president, Prof. A. L. Rae; secretary-treasurer, Mrs. D. B. Robertson; committee, Col. T. Durrant (retiring president), Dr. K. J. Mitchell, and Messrs. D. M. Smith and R. A. Barton; editor of "Proceedings", Mr. J. Gerring.

No venue for the 1957 conference was decided and the executive will consider its abandonment or its being held in association with the conference of the Australian and New Zealand Association for the Advancement of Science in Dunedin in January 1957.

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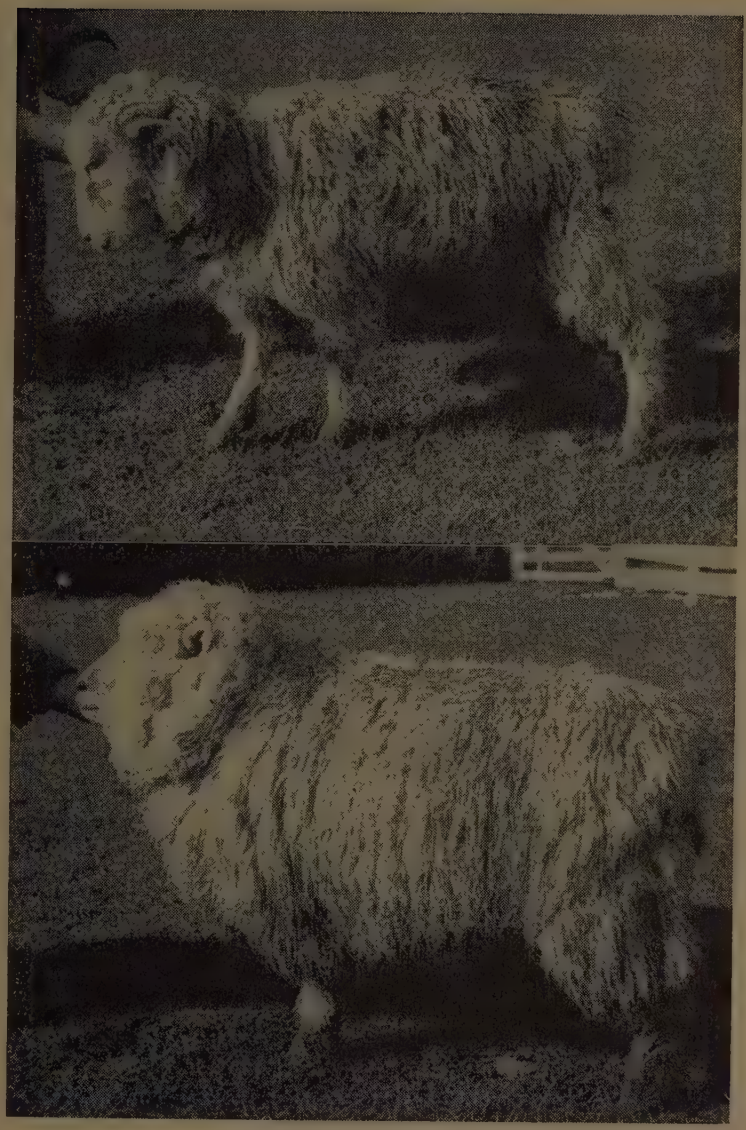
Cobalt Deficiency

By E. D. ANDREWS,
Senior Biochemist, Department of Agriculture Animal Research Station, Wallaceville

THE occurrence, diagnosis, and control of cobalt-deficiency disease in cattle and sheep were dealt with in "The New Zealand Journal of Agriculture" for November 1939. This article was later issued separately as Bulletin No. 180 of the New Zealand Department of Agriculture, which was last revised in 1954. Because of the continuing importance of cobalt deficiency as a factor limiting the thrift of young sheep the occurrence, diagnosis, and prevention of the disease in these animals receive special emphasis in this article, which supplements the information contained in Bulletin No. 180.

SOME 20 years ago Australian workers found that cobalt compounds would cure and prevent a wasting disease of cattle and sheep. Later, New Zealand investigations showed that similar-appearing diseases in this country (bush sickness, Mairoa dopiness, and Morton Mains disease) could also be cured and prevented by cobalt. In affected areas the cobalt contents of soils, pastures, and animal livers were lower than normal. Results from the New Zealand investigations thereby confirmed the Australian work which indicated that cobalt in feed was essential for the health of cattle and sheep.

In 1948 British and American workers isolated a new growth factor, which they called vitamin B_{12}, and found that it contained cobalt. All higher animals need the vitamin, cattle and sheep apparently requiring much more than do other animals. In cattle and sheep vitamin B_{12} is elaborated in the rumen or paunch by microbes. For this purpose they use the cobalt naturally contained in feed. If cobalt intake is lower than normal, production of vitamin B_{12} is restricted and unthriftiness results.



Lambs from the same flock on marginally cobalt-deficient land at Wallaceville. Upper—Untreated. Lower—Given weekly doses of cobalt.

Cobalt Deficiency in Stock

Only ruminants are susceptible to cobalt deficiency. Horses, for example, are immune.

Young growing sheep are the most sensitive of all animals to cobalt deficiency. Next are mature sheep, calves between 6 and 18 months old, and mature cattle in that order.

On severely deficient land sheep of all ages and in some places cattle lose their appetites, become progressively emaciated, and, unless the deficiency is corrected, ultimately die. In New Zealand these areas are now fairly well defined and the disease in cattle and mature sheep is no longer a major problem, provided cobalt is supplied regularly.

There are, however, areas where the cobalt content of soils is only mildly to moderately deficient. Still other soils have been tentatively described as marginal or suspected cobalt deficient. Within the areas represented by these two groups mature cattle and for the most part calves and mature sheep remain in apparent good health, but young growing sheep can become unthrifty to a greater or less degree. On this kind of land symptoms rarely occur in lambs during their first few months of life. Unthriftiness usually appears between the third and sixth months, depending on the degree of deficiency, though not all lambs in a flock are equally affected. A few may thrive, some fail only to put on as much weight as might be expected,

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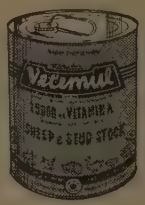

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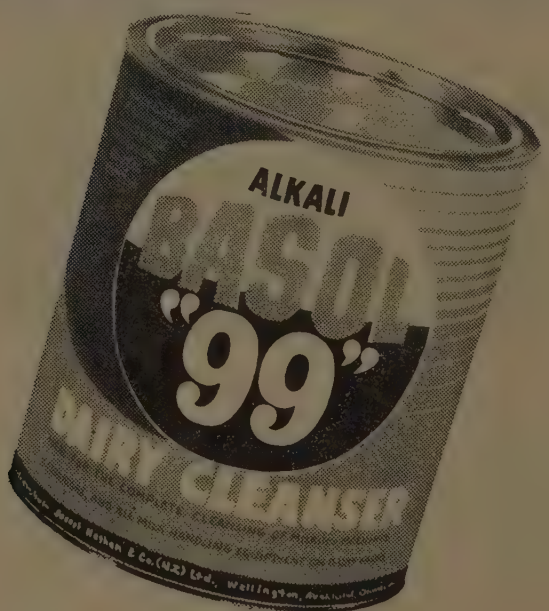

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and others waste away. Frequently the wool is white or "washy" in appearance, some animals may appear anaemic, and sometimes there is a discharge from the eyes.

In mild cases mortalities are negligible, but if the disease is more acute the death-rate can be quite high during autumn. During late winter and early spring surviving sheep tend to recover, but as 2-tooths they may again enter a second period of unthriftiness in late spring and summer. The disease can be variable in place and time. Some paddocks on the same farm or even the same kind of soil may be obviously worse than others and the degree of unthriftiness can vary from year to year.

Wallaceville Trial

The illustration on page 239, which shows the results of an experiment still in progress on a cobalt-deficient paddock at Wallaceville, typifies the milder form of cobalt-deficiency disease in young sheep. In this trial a mob of lambs was divided into two groups. In one group each animal received weekly doses of cobalt and in the other animals were left untreated as a control group for comparison. In the untreated group the effects of deficiency were becoming evident by the end of January 1953, and by the middle of March there was an 11lb. difference in favour of the cobalt group. The difference was maintained over winter and during early spring, when both groups started to gain weight more rapidly. The untreated group slipped back a little between October and November.

After shearing growth-rates in both groups improved, but this was not maintained in the untreated group and in February of 1954 the cobalt-dosed sheep averaged 119lb. as against 78lb. for the control group, a difference of 41lb. After April 1954 animals in the untreated group continued to gain weight, indicating that sheep tend to outgrow their susceptibility to mild cobalt deficiency. Only one death attributable to cobalt deficiency occurred in the untreated group, but the greater thrift of the cobalt-dosed sheep is apparent.

Phalaris staggers: This condition can develop in cattle and sheep after a few weeks grazing on practically pure stands of *Phalaris tuberosa*, usually at a young growing stage. The disease is characterised by muscular tremors, is accentuated by exercise, and in severe cases animals will stagger or fall to the ground in convulsions. There are some deaths. Mildly affected animals can apparently recover when moved to other pastures, but more severe cases do not recover.

Recently South Australian workers were able to prevent phalaris staggers in sheep on marginally cobalt-deficient land by dosing with cobalt. Since the disease has been reported in New Zealand, the possibility of using cobalt to prevent the condition is to be examined.

Phalaris staggers differs from so-called ryegrass staggers which sometimes affects cattle and sheep in this country. Recent work has shown that ryegrass staggers in sheep cannot be prevented by giving extra cobalt.

Cobalt-deficient Areas

Cobalt-deficient areas are represented as black, hatched, or shaded areas in the map on this page, which was prepared with the assistance of the Soil Bureau, Wellington, and the Cawthron Institute, Nelson. Data used in constructing the map include

results indicating responses of animals to cobalt and results from the analyses of livers, pastures, or soils for cobalt content. Finally, deficient or suspected-deficient localities as determined from the data have been plotted on soil maps and the appropriate areas extended to include soils of the same or similar type irrespective of the extent to which they are at present farmed.

Severely Deficient Areas

Black areas indicate that soils and pastures are severely deficient in cobalt. Before the advent of cobalt supplementation sickness and death among stock made the farming of this kind of land virtually impossible. In the North Island the areas include much of the Central Plateau and consist of pumice soils formed from the Taupo and Kaharoa ash showers, which are low in cobalt, and strongly leached volcanic soils derived from the Mairoa shower in the west.

In the South Island, soils derived from granite are severely deficient in cobalt. Those farmed occur principally in the Nelson Province at Glenhope and in the Sherry Valley, Dart Valley, and Wangapeka districts. In Westland granite-containing cobalt-deficient soils (for example, Ahaura stony sandy loam) used for farming are found mainly on the terraces in the Grey-Reefton valley. "Pakihi" soils near Westport are severely cobalt deficient as are recent blown sands near the coast at Westport and Karamea. A small area considered to be severely cobalt deficient is at the northern end of the Whanganui (West Haven) Inlet.

Mild to Moderate Deficiency

Hatched areas represent mild to moderate cobalt deficiency. In North Auckland deficient soils are derived from volcanic ash and rock from which much of the cobalt has been leached out or is in a form not readily available to pasture plants. A large tract of mountain soils west of Lake Waikaremoana where the cover of Taupo ash has been partially thinned by erosion has been classed in this group, but little of the land is at present farmed. Included also are moderately leached stony soils containing volcanic ash west of Waipukurau and similar soils (for example, Takapau stony loam) forming a large part of the Wairarapa Plain. A number of reports from Wairarapa indicate a good response of lambs to cobalt, and the soil is similar to that on which cobalt deficiency has been shown to occur at Wallaceville.

In the Nelson Province "pakihi" lands at Onekaka and Collingwood are classed in this group. In South-land the principal area, which consists of leached or podzolised soils, is to the north-east of Invercargill and bounded by the Makarewa River and Mataura River basins. Work carried out by the Cawthron Institute and Department of Scientific and Industrial Research in the Morton Mains district established that a lamb unthriftiness disease, often attended by heavy mortalities, was due to a deficiency of cobalt.

Marginal Deficiency

Shaded areas indicate soils of which some may be marginal in available-cobalt content. Most farms within these areas are at present probably free from cobalt-deficiency disease, but may not necessarily always remain so. Where unthriftiness in young sheep is found cobalt deficiency can be suspected as at least one possible cause. In North Auckland, gumland soils derived from claystone, sandstone, dacite, and alluvial parent materials have been classed in this group. Included also are various soils on the margins of the great ash showers of the North Island where the ash is thin.

Experiments carried out on sand country at Foxton suggest that a marginal deficiency of cobalt may limit the growth of lambs at places within a coastal area extending from Paekakariki to Patea and classed as Patea sand and Whananaki sand. Soil analyses suggest that the strongly leached Waita, Waiuta, and Okarito ("pakihi") soils of the west coast of the South Island may be deficient in cobalt, but much of this land has so far not proved suitable for farming.

In Canterbury extensive areas of fairly leached stony soils, of which Lismore stony silt loam and Ruapuna stony silt loam are representative, are similar in texture to the cobalt-deficient soils of Wairarapa. Unthriftiness among young sheep in Canterbury is frequently associated with livers low or on the borderline in cobalt content. These soils are therefore suspect, but more definite evidence awaits the completion of animal trials at present either in progress or contemplated.

In Otago and Southland cobalt deficiency as indicated from reports of responses to cobalt and analytical results can occur on a variety of soils and no close correlation between soil types and the actual incidence of cobalt-deficiency disease is so far evident. Provisionally, leached soils have been mapped as suspect. On one gleyed soil near Winton (Otapiri silt loam) cobalt-dosing trials have shown clear evidence of cobalt-deficiency disease in lambs.

Though the Chatham Islands are not shown on the map, parts of them appear to be deficient in trace elements. Much of the land consists of peat and sandy soils, and analyses of livers indicate a deficiency of copper or cobalt or both.

Broad Indications Only

Distinctions shown on the map are necessarily arbitrary and are intended only to give broad indications. Areas will tend to merge one into the other and in some cases will overlap. Because of water sorting and other soil-modifying processes and the necessity for generalising in constructing a small-scale map some areas shown as deficient will be healthy. The absence of detailed knowledge of small blocks of land and incomplete data concerning the possible influence of climate and farm management make this particularly true for the marginal or suspect (shaded) areas.

Conversely pockets of cobalt-deficient land may be located outside the areas indicated as deficient or suspected deficient. Much of the areas shown is unsuitable for farming. Thus the better-recognised cobalt-deficient areas (black plus hatching on the map) total approximately 7½ million acres, but of this only 3½ million is at present farmed.

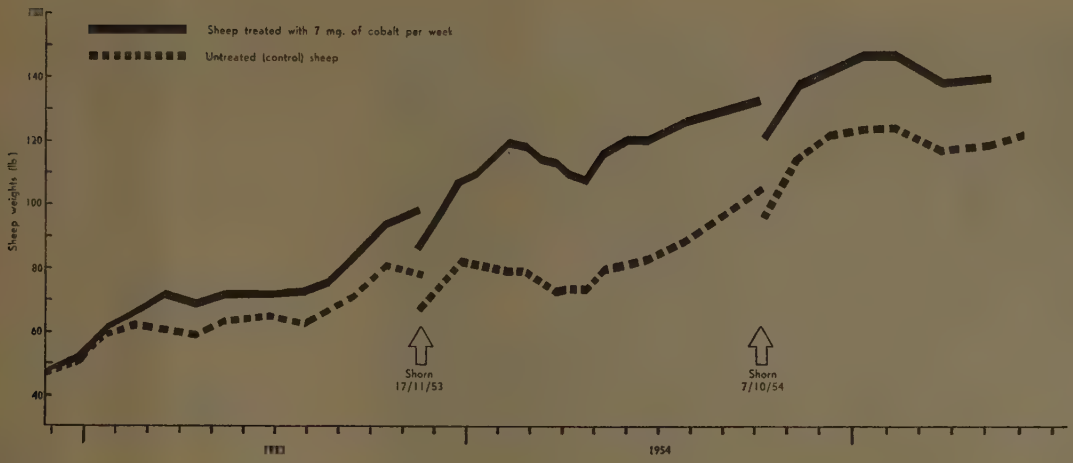
Factors which May Influence Cobalt-deficiency Disease

Since the severity of cobalt-deficiency disease is generally determined by cobalt intake, factors which govern the availability of soil cobalt to pasture plants, or otherwise determine the amount of cobalt ingested with the pasture, will influence the degree of unthriftiness to which animals are subjected.

It has been found that generally the cobalt content of pastures tends to increase in late autumn and winter and to decrease in spring and summer. Consequently, though on severely affected land animals are continuously subjected to a deficiency of cobalt, the disease appears to be most acute during the latter period. Similarly on more mildly affected areas seasonal variation in cobalt content of pastures offers a partial explanation of the greater susceptibility of young sheep to cobalt deficiency as weaned lambs during summer and again as 2-tooths during the following spring-summer period.

Superimposed on seasonal variations within a given year, year-to-year fluctuations in the thrift of successive crops of young sheep on mildly or marginally deficient land suggest that their cobalt intake can change significantly from one year to the next according to the kind of season. New Zealand observations indicate that seasons favouring lush growth tend to cause development of the disease.

Because considerable differences are found in the cobalt content of different pasture plant species, it can be expected that changes in the botanical composition of pastures from time to



Response in Wallaceville experiment of young growing sheep to cobalt on marginally cobalt-deficient land.

time or from place to place may influence the degree of deficiency experienced by grazing animals. Legumes take up considerably more cobalt than do grasses grown in the same environment. Perennial ryegrass, though not as high in cobalt as are legumes, tends to absorb more of the element from the soil than do other grasses. Typical cobalt contents of pasture species expressed as parts per million (p.p.m.) on a dry-weight basis are shown in Table 1.

TABLE 1

Plant species	Cobalt (p.p.m.)
Timothy	0.09
Cocksfoot	0.11
Meadow fescue	0.12
Short-rotation ryegrass	0.13
Perennial ryegrass	0.16
Red clover	0.23
White clover	0.24

This means that though cobalt-deficiency disease can and does occur on pastures containing any of the usual mixtures, other things being equal on marginally cobalt-deficient land pastures dominant in clovers, or to a less extent perennial ryegrass, are less likely to be cobalt deficient than those in which other grasses are dominant. Differences in the cobalt uptake of different pasture species should not, however, be a major consideration in determining the botanical composition of pastures, since cobalt deficiency in any species can be easily corrected by cobalt topdressing.

On marginally cobalt-deficient land lenient grazing of pastures is more likely to induce cobalt-deficiency disease in weaned lambs than heavy grazing. The reason for this is not entirely clear, but may lie in the fact that soil is richer in cobalt than the pasture it grows, so that the consumption of soil-contaminated pastures could protect animals from cobalt-deficiency disease. This does not mean that the prevention of cobalt deficiency should be attempted by overstocking, because this will itself induce unthriftiness, owing to underfeeding.

Other farm management practices such as drainage, cultivation, irrigation, cropping, and the use of fertilisers may possibly modify soil characteristics and thereby influence the amount of cobalt available to pasture plants.

However, there is no good reason why any normal management practice should be avoided merely because of its possible effect on cobalt status.

On the other hand better knowledge of the way in which these factors work will increase the ease with which cobalt-deficiency disease can be recognised and prevented.

Diagnosis

Where cobalt deficiency is suspected the first step is to arrive at a correct diagnosis. Since the signs of cobalt-deficiency disease are those of simple starvation, diagnosis cannot be made on symptoms alone. The disease can easily be confused with other causes of unthriftiness such as worm infestation, chronic starvation, and hogget ill-thrift of unknown cause. It must be emphasised that cobalt is not a cure-all and results from its administration to unthrifty animals not affected with cobalt-deficiency disease are bound to be disappointing.

Preliminary indications of the possibility of cobalt deficiency are as follows:—

1. Since young sheep are the most susceptible to cobalt deficiency, cobalt deficiency is excluded if cattle and mature sheep are unthrifty where young sheep thrive.
2. If weaned lambs (or 2-tooths) do not thrive though cattle and mature sheep do well, cobalt deficiency is a possibility.
3. If unthrifty animals improve when transferred to other areas, cobalt deficiency is a possibility.
4. If the farm is on a soil type on which cobalt deficiency has been known to occur or is within an area mapped as marginally deficient or suspected to be cobalt deficient (shaded), cobalt deficiency as a cause of unthrift in young sheep is a possibility. If the farm is situated within the generally more deficient areas (hatched plus black), cobalt deficiency in mature sheep or even cattle may occur and the possibility of cobalt deficiency as a cause of unthriftiness in young sheep is strengthened.

None of these indications suggesting cobalt deficiency is, however, sufficient in itself to justify a definite diagnosis.

Veterinarians, Livestock Instructors, or Instructors in Agriculture of the Department of Agriculture should be consulted in cases of suspected cobalt deficiency. If it is considered necessary, these officers will obtain samples

of livers from unthrifty sheep on the farm for cobalt analyses. Because of regular applications of cobalt to the more severely affected land cobalt-deficiency disease among cattle is now unlikely and bovine livers are rarely examined. In any case samples from calves less than 9 months old are unsuitable, because results cannot be adequately interpreted on the basis of existing criteria.

Livers from animals which have been given cobalt-containing drenches or licks will be high in cobalt and are therefore quite useless for analysis. Care must also be taken that samples are not contaminated from anything which may have been in contact with cobalt, for example, utensils, hands, or clothes. With each sample a detailed description of the circumstances pertaining to the trouble should be given. This will greatly facilitate diagnosis. Samples will be forwarded to Wallaceville for analysis by the most rapid means of transport available. Results will be sent back to the officer forwarding the samples, who will advise the farmer as to what course should be taken.

Best Method of Diagnosis

Though liver analyses offer a valuable aid to the diagnosis of cobalt deficiency, interpretation of results is not always clear cut, especially where unthriftiness is less marked. Sometimes results can be interpreted only as borderline or **suggestive** of cobalt deficiency.

The most conclusive method of diagnosing cobalt-deficiency disease is to assess the response of animals to supplements of cobalt administered by mouth.

For this reason, if it is considered practicable, advisory officers will recommend a cobalt-dosing trial. A convenient drench may be made by dissolving 1oz. of cobalt sulphate crystals in 1 pint of water; 3½ fl. oz. of this solution is diluted to 1 gallon. One fluid ounce of the diluted solution is given to each sheep each week (5 fl. oz. for cattle).

With lambs trials are best carried out during the summer to autumn period after weaning or with 2-tooths during the following spring; that is, during periods when responses to cobalt would be expected to be greatest. Test animals should be divided into two groups as even as possible in average size or bodyweight. One group should receive regular doses of cobalt each week and the other (control) group should be left untreated. Trials should be continued for 2 to 3 months, but may be terminated sooner if there is an obvious response to cobalt.

Often improvement in thrift can be assessed by eye as illustrated on page 239), but where unthriftiness is milder test animals should be weighed at least twice—at the beginning of the trial and at the end. With 12 or more animals in each group an average weight gain difference of more than 6lb. in favour of the cobalt-dosed group will usually be indicative of cobalt deficiency.

If cobalt-dosed animals make significantly better weight gains than untreated animals, cobalt deficiency is confirmed.

Treatment and Prevention

Cobalt-deficiency disease can be cured and prevented by ensuring that adequate supplies of cobalt are available in the diet. Three standard practices are used.

Drenches: As previously indicated drenches are of great value in arriving at a diagnosis of cobalt deficiency. Because of the labour involved in drenching, its practical usefulness is otherwise limited. Nevertheless, when proof of cobalt deficiency has been established and animals are obviously losing weight drenching should be instituted until such time as cobalt can be got on to the ground.

Licks: Cobaltised salt licks should contain not less than 4oz. of cobalt sulphate per ton of lick. The value of licks is limited, as many animals may fail to take them and so lose the benefit of the contained cobalt. However, licks have a place on hill country properties where topdressing has not hitherto proved feasible. With the increasing use of aircraft to spread superphosphate (and hence cobaltised superphosphate) the necessity for cobaltised licks should diminish.

Cobalt topdressing: Prevention of cobalt-deficiency disease is best assured when the cobalt content of pasture plants is raised above deficiency levels by topdressing with cobalt compounds at sufficiently frequent intervals. The length of time during which topdressings remain effective depends mainly on the amount of cobalt applied, though to some extent it may be influenced by rainfall and soil characteristics.

Experiments with fairly heavy cobalt applications have given rather variable results, but it has been shown that cobalt sulphate spread from the air to give a rate of 20oz. of the compound per acre will prevent cobalt deficiency disease on pumice soils for approximately 3 years. Lighter applications (5oz. per acre of cobalt sulphate each year) are recommended and will raise the cobalt content of pastures above deficiency levels for periods up to 12 months. Stock grazing throughout the year on pastures topdressed at this rate will remain healthy.

Cobalt sulphate can be mixed with other fertilisers and nowadays the usual practice is to apply it as cobaltised superphosphate.

Cobaltised superphosphate manufactured in the North Island contains 3lb. of cobalt sulphate per ton, so that annual applications at 2cwt. per acre will provide the required 5oz. of cobalt sulphate. In the South Island cobaltised superphosphate contains 6lb. of cobalt sulphate so that annual applications of 1cwt. per acre will give the required amount of cobalt. If heavier applications of fertiliser are used, the additional quantities need not be cobaltised

As topdressing with superphosphate is commonly carried out in autumn, cobalt is usually applied as cobaltised superphosphate at this time. But where pregnant ewes are wintered on crops it is preferable to apply cobalt to pastures for their lambs during the following late spring or early summer; that is, just before the time when extra cobalt for lambs may be needed. A suitable method is to spray pastures with cobalt sulphate solution to give the recommended 5oz. of the crystals per acre.

Table 2 compares the cobalt contents (in parts per million) of various winter feeds with the content of pasture.

TABLE 2

Sample	Cobalt (p.p.m.)
Pasture	0.08
Chou moellier	0.06
Kale	0.11
Turnip tops	0.08
Turnip roots	0.05
Oats	0.06

These figures indicate that winter feeds on cobalt-deficient land should be sown with the required amount of cobaltised superphosphate every year. Autumn-saved pastures should receive cobalt in the usual way during autumn.

The possibility that only some parts of a farm may be cobalt deficient should not be overlooked, though where doubt exists cobalt topdressing should be carried out on all paddocks.

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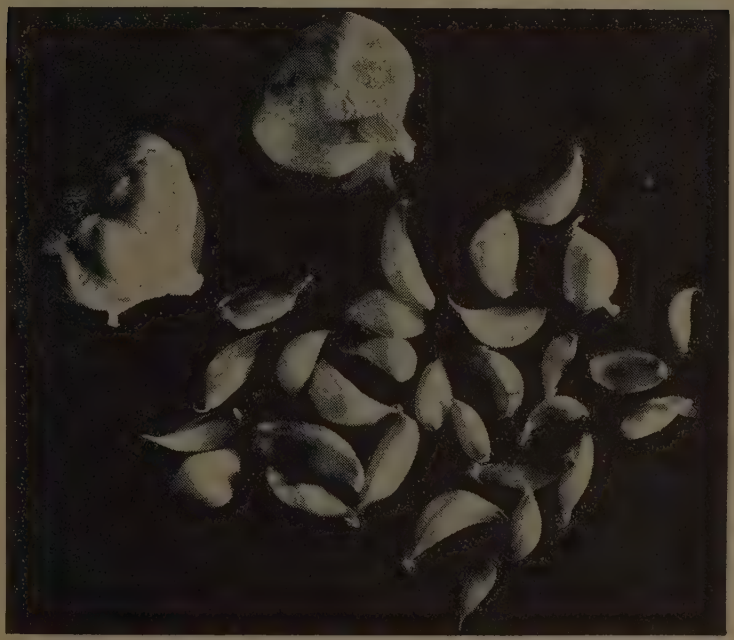
Garlic Growing in Marlborough

By D. W. McCALLUM,

Horticultural Instructor, Department of Agriculture, Blenheim



[*Gordon McCusker*

At upper left are good-quality bulbs correctly trimmed. The cloves came from one bulb, indicating nearly a thirty-fold increase from the original clove planted.

OF all the members of the onion family which have been grown since time immemorial none has had a more chequered career than garlic (*Allium sativum*). Originating in Central Asia it was a delicacy of kings, but later the Romans disliked its pungent flavour and fed it to their slaves and labourers. The Bible states that the Israelites in the wilderness complained bitterly to Moses about the lack of garlic. It is still widely used on the Continent and in eastern countries, but has never been in very great demand in New Zealand. The Wairau Plain near Blenheim has climate and soil conditions well suited to the growing of garlic and this article describes the cultural methods employed.

THE bulbous root of garlic is unexcelled for flavouring sauces and pickles. It is used mainly in commercial manufacture and only to a limited extent in home condiments. As the requirements are so small, it is not commonly grown in the home garden and therefore is not always readily available; otherwise garlic might be used more in home manufacture to give added flavour to sauces and pickles.

Garlic is a hardy perennial, bulbous plant, and the bulbs are composed of several separate parts or bulbils called cloves. Each of these cloves when planted multiplies and again forms a bulb. Though garlic will grow from seed, propagation is usually by vegetative means and consequently a very true and even line is obtained.

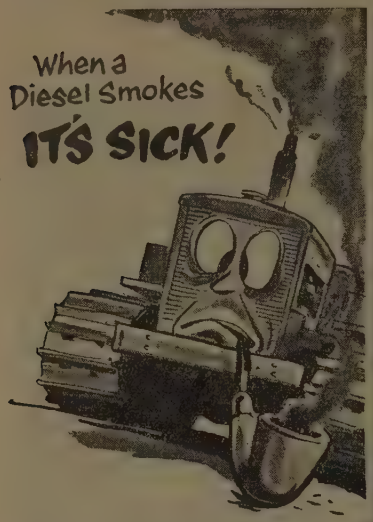
Garlic laid out to dry after being dug. The roots have yet to be trimmed.

Soil and Climatic Requirements

A deep and free-draining silt or sandy loam appears to give the best results, but garlic is very tolerant of indifferent soil conditions. The soils around Blenheim on which garlic is grown have a pH (lime status) of 6.0 to 6.4 and this is well suited to the crop. The main growing period is in spring and rain at this time assists in promoting vigorous growth; dry conditions are desirable during the ripening period in January.

Planting

Planting may be carried out at any time from May until August. Early planting is recommended, as a spring drought will undoubtedly affect cloves put out in early spring unless irrigation is possible. The bulk of the garlic is grown under contract to one or other of the seed firms and the stock for planting is supplied by them. The grower splits the bulbs into individual cloves, which vary a great deal in size.



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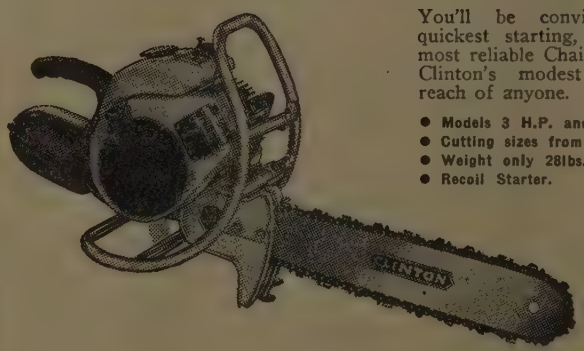

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Trimming the roots is done with sheep shears as soon as possible after the crop is lifted. If the crop is left too long before root cutting, the roots become wiry and hard.

Overseas authorities advise discarding very small or very thin cloves, but the general practice in Marlborough is to plant them all. The practice of discarding the smaller cloves seems to have much to commend it, as these generally produce smaller bulbs. A trench 2in. to 3in. deep is opened and the cloves pressed in by hand about the same distance apart. Ideally the cloves should be covered by about an inch of soil, but this will vary a good deal according to the size of the clove. Overseas practice is to plant the cloves nearly 6in. apart, but under local conditions closer planting seems to give quite good results. With rows spaced 15in. apart 4cwt. of bulbs is sufficient to plant an acre.

Cultivation

In land that has been well prepared little cultivation is necessary and is limited to weed control. Garlic roots deeply, but some 6 weeks after planting the space between the rows is filled with a mass of roots an inch or two below the surface of the soil. Injury to these through too deep hoeing has a detrimental effect on the crop yield. Excellent crops have been observed where the soil (a silt loam) has packed down quite hard.

Harvesting

In January the top growth turns brown and the crop is ready for harvesting. Small areas (¼ acre or less) are usually dug by hand and large areas are ploughed out.

It is important that the foliage does not ripen off fully before the bulbs are lifted; if it does, lifting is made much more difficult, as the leaves break away from the bulb as it is being pulled from the ground.

As soon as the bulbs are lifted the roots are trimmed back, as they become hard and wiry if left to dry, and the bulbs laid out to cure in the sun. When the bulbs are cured the tops are trimmed back and the bulbs bagged. This ripening process is very important, as bulbs are liable to heat in store if too much moisture is left in and the keeping quality is impaired.

Pests and Diseases

Garlic is resistant to many of the pests and diseases which attack related crops. The onion thrips (*Thrips tabaci* Lind.) causes a small amount of damage in some seasons, but not sufficient to justify the trouble or expense of spraying. *Sclerotinia sclerotiorum* and *Fusarium* species have been recorded, but if healthy cloves are planted and the crop is not grown too frequently in the same area, losses from these diseases are negligible.

Last spring a more serious disease called white rot (*Sclerotium cepivorum*) was recorded on a crop of garlic. This disease, which affects onions and related crops, had not previously been recorded in the Blenheim district, and in an endeavour to prevent its spread the Department of Agriculture, with the co-operation of the grower and the contracting merchant, destroyed the crop.

Production Trends

Until 1955 the area planted in garlic decreased steadily each year, and in 1954 the total area did not exceed 5 acres. There were various reasons for this, but perhaps the main one was the fact that returns from other crops which grow well in the district were greater than those from garlic and growers generally preferred to plant crops where their implements could be used to greater advantage than with garlic, where the bulk of the planting, cultivating, and harvesting is by hand. However, an increase in 1955 of the contract price from 4d. to 6d. per pound of clean garlic harvested has resulted in a considerably larger area being planted. Some 15 acres were let out in the 1955-56 season.

It is reasonable to expect at least a twenty-fold increase over the weight of cloves planted. For example, the yield from an acre of garlic planted with 4cwt. of bulbs should be about 4 tons. This weight would provide a return of just over £200 after payment for the original bulbs planted, and after deduction of the labour costs of growing the crop the net return per acre would be from £130 to £150.

A small amount of "free" garlic is grown, but as the merchants usually prefer to grow under contract and to provide the original bulbs, growers not under contract sometimes have difficulty in disposing of their crops.

A large area of drying garlic.

Care of Livestock during April

Contributed by the Animal Research Division

DECEMBER-FARROWED PIGS

LITTERS farrowed in December should be sold as pork. If they are carried on to bacon weights, no milk will be available for the later litters, which will have to be sold cheaply as stores or wintered on expensive concentrates. Available root crops may be fed to sows, but they require supplementing with milk or meat meal.

TUBERCULOSIS IN POULTRY

Tuberculosis not only causes considerable loss in poultry, but it frequently spreads to pigs, with consequent condemnations at the meat works. If this disease is suspected, veterinary aid should be sought with a view to eliminating affected birds.

CARE OF EWES

If rams remain with the ewes for more than 4 weeks, they should be raddled on the brisket so that the late-lambing ewes can be drafted off. Once the ewes are in lamb the level of feeding should be lowered to prevent their becoming too fat. If the rate of stocking is increased during autumn, some paddocks can be shut up and pasture allowed to grow for grazing during the 3 weeks before lambing. These measures will greatly assist in reducing "sleepy sickness", which is more prevalent in fat ewes which are inadequately fed just before lambing. Ewes well fed during the month before lambing produce on the average half a pound more wool per head than those underfed during this period.

CARE OF LAMBS

If summer and autumn have been wet, lambs are likely to be suffering from worms. Drenching with phenothiazine 2 or 3 times at monthly intervals will help. This applies particularly to the tail of the flock, which should be drafted off for special attention. Feed, however, is the most important consideration. During autumn lambs do best if grazed on pastures which have been allowed to grow to a height of 4in. to 6in. Hay aftermath and clover are very good. If these are not available, the lambs should be distributed thinly over the dairy paddocks or on hill pastures. They should on no account be concentrated in large numbers on short, rapidly growing pastures, especially if these have previously been grazed by ewes and lambs.

PURCHASE OF HERD SIRE

If a new herd sire will be required this year, now is the time to make inquiries. The New Zealand Dairy Board issues a Sire Survey and Merit Register, which gives the production of the daughters of all dairy sires which have been surveyed. Unfortunately very few progeny-tested sires are available, but the Register should be consulted and wherever possible a bull by a proven sire out of a merit cow should be selected. Bull catalogues are issued annually by the Herd Improvement Association and these, too, should prove of considerable value to dairy farmers who are looking for herd sires. The New Zealand Dairy Board is now developing artificial breeding on a commercial basis and farmers interested in making use of this service should get in touch with their local Herd Improvement Association.

CARE OF CALVES

The best way to prevent calves dying during winter is to treat them properly during autumn. They should never spend more than 2 or 3 days in one paddock, and should be rotated ahead of the cows through the best paddocks available. Good-quality hay should be provided for them daily, especially when the feed is growing fast after autumn rains. Set stocked calves should be drenched with phenothiazine as soon as scouring is noticed.

DRYING OFF DAIRY COWS

A dairy cow requires a reasonable spell between lactations, and should be dried off at least 6 weeks before she is due to calve. This should be done even if she is still milking heavily. The drying-off process need not be prolonged; it is quite safe just to stop milking, provided any quarters affected with mastitis are treated with the usual course of 3 tubes of penicillin, the last tube being given after the cow is milked for the last time.

AUTUMN-SAVED PASTURE

Early-calving cows are nearly always short of feed during July and August, and often during September. In most seasons pasture is not growing fast enough during these months to meet the requirements of milking cows. Crops are expensive to grow and concentrates are even more expensive to buy. It costs nothing, however, to shut up pasture in the middle of April and let it grow for use in early spring. As much as possible of the dairy area should be shut up in this way. Advice regarding the best paddocks to spell and the best method of feeding the autumn-saved pasture by the use of electric fences can be obtained from local officers of the Department of Agriculture.

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during January and for the 6 months ended 31 January 1956, with comparative figures for the same month and 6 months of 1954-55, have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER

Period	Creamery (tons)	Whey (tons)	Total (tons)	Percentage Inc. or dec.
January 1956	20,985	359	21,344	—
January 1955	19,175	384	19,559	—
Increase or decrease ..	+1,810	—25	+1,785	+9.126
6 months ended 31/1/56	118,668	1,984	120,652	—
6 months ended 31/1/55	112,127	2,081	114,208	—
Increase or decrease ..	+6,541	—97	+6,444	+5.642

Butter in store at 31 January 1956 was 30,396 tons

CHEESE

Period	White (tons)	Coloured (tons)	Total (tons)	Percentage Inc. or dec.
January 1956	9,959	1,989	11,948	—
January 1955	10,759	1,658	12,417	—
Increase or decrease ..	—800	+331	—469	—3.777
6 months ended 31/1/56	51,694	8,438	60,132	—
6 months ended 31/1/55	53,634	13,714	67,348	—
Increase or decrease ..	—1,940	—5,276	—7,216	—10.714

Cheese in store at 31 January 1956 was 24,410 tons

If these figures are converted into butterfat equivalent, there is an increase of 2.209 per cent. in butterfat graded for the 6 months as compared with the corresponding period of the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place from time to time they are not necessarily a true indication of production trends.

Autumn Fertiliser Applications

Seasonal Notes by the Extension Division

IN arranging the programme of autumn fertiliser and lime applications it is important to see that the fertilisers chosen are suitable for the pastures or crops on particular soils and that they are applied at a suitable time. Many soils require lime in addition to fertiliser, and liming programmes should be completed before wet weather sets in. The less accessible areas should be done first while the ground is still firm enough to support loads and give traction.

PHOSPHATIC TOPDRESSING

QUICK-ACTING phosphatic fertilisers such as superphosphate, basic superphosphate, or serpentine superphosphate applied early enough in autumn to catch the autumn flush and before the weather gets too cold will improve production of pasture for winter use. For these fertilisers to give good results the land should be supplied with its requirements of lime. The autumn growth, enhanced by timely applications of superphosphate, can be held for later feeding to cattle and sheep and will add to the quantity and quality of feed available in winter. If superphosphate is applied too early while the soil is still dry, it may burn the foliage of the pasture and for a short period retard growth slightly. Though this slowing up of growth is not serious, it is better avoided by timing applications to coincide better with the break of the weather in autumn.

POTASSIC TOPDRESSING

Potash deficiency is becoming increasingly common on North Island dairy farms, particularly on soils of volcanic origin. If pastures on dairy farms are not improving or maintaining a reasonable standard of production, potash deficiency can be suspected, if the needs of lime and phosphate have been met. Potash deficiency is much more common on dairy farms than on sheep farms and is more likely on portions of the farm which are closed frequently for hay or silage or on fields which have not received their share of night grazing.

Peat soils, many volcanic soils, and extremely leached soils derived from sedimentary rocks are liable to be deficient in potash and this deficiency is apparent whatever the type of farming adopted. Any deficiency should be met as soon as possible and except on peat soils potash can be applied with advantage in April. Applied then it will assist winter growth. On peat soils potash leaches rapidly and is therefore better applied in spring.

NITROGENOUS TOPDRESSING

On town milk supply farms quick-acting nitrogenous fertilisers such as sulphate of ammonia or ammonium nitrate can be applied in April to improve winter production of pasture. It can also be applied then to crops such as greenfeed cereals and the results are particularly impressive on newly sown temporary pasture containing large amounts of Italian or short-rotation ryegrass. With the great demand for green fodder throughout winter to keep up a heavy flow of milk these fertilisers certainly have a place on town supply farms.

On dairy farms supplying factories cows do not come into profit until about July and the need for such growth is not in evidence until then. The required feed can generally be supplied by closing in April fields topdressed with their needs of superphosphate and potash. However, if these measures do not meet the position, nitrogenous fertilisers can be used about July to give an extra boost when the autumn reserves have been eaten. Nitrogenous fertilisers should be applied to pastures in good heart and containing a high percentage of ryegrass. Applications should be made during mild, showery weather, which is usual in April in most dairying districts. Nitrogenous fertilisers should be applied with phosphate; 2cwt. of superphosphate plus 1cwt. of sulphate of ammonia is a reasonable dressing.

—J. E. BELL

* * *

MINOR ELEMENTS

MINOR element applications should be made only where there is definite knowledge of deficiency and information should be sought from local instructors as to the need, amount, and period between repeat applications. Cobalt, copper, and molybdenum are the three chief minor elements and each should be applied only on deficient soils.

COBALT

Cobalt is not known to affect plant growth, but is necessary for the development and health of sheep and cattle. As a regular intake of this element right through the year is essential, the most satisfactory method of correcting a deficiency is by applying cobalt to the soil so that pastures growing on this soil will contain an increased amount of this element for an extended period. Satisfactory control of cobalt deficiency is achieved by the application of 5oz. of cobalt sulphate per acre each year.

Cobaltised superphosphate is manufactured in both islands and in the North Island 1 ton of cobaltised superphosphate contains nearly 3lb. of cobalt sulphate. To apply 5oz. of cobalt sulphate therefore it is necessary to use cobaltised superphosphate at 2cwt. per acre. In the South Island cobaltised superphosphate contains twice the amount of cobalt, so that only 1cwt. per acre each year of this material need be applied.

MOLYBDENUM

Topdressing with molybdenum is most conveniently combined with that of superphosphate or superphosphate-derived fertilisers on all soils which respond to phosphates and also require molybdenum. In the North Island 3cwt. of molybdic superphosphate contains about 2oz. of sodium molybdate (14.3oz. per ton); in the South Island 2cwt. of molybdic superphosphate contains about 2oz. of sodium molybdate (1lb. 6oz. per ton).

Molybdenum in excess of 2oz. or 3oz. of sodium molybdate per acre should not be applied and molybdenum topdressing should not be repeated without consulting the local Instructor in Agriculture.

COPPER

Copper topdressing can do harm to stock if carried to excess, particularly on light land receiving not enough rainfall to leach out quickly the soluble salts applied by topdressing. On the other hand copper is essential for stock health and plant growth. For the control of copper deficiency in stock 5lb. of copper sulphate per acre each year suffices on most soils on which stock do not thrive without copper. This amount of copper sulphate is supplied by 2cwt. of copperised superphosphate (56lb. of copper sulphate per ton).

There may be several soils on which the addition of copper may also increase pasture growth, but knowledge of the action of copper on pastures in New Zealand is unfortunately rather incomplete. It seems, however, that only in a few instances is copper severely limiting growth. In peat areas pasture responses to copper have been slight only or not observed at all unless the soil was well fertilised and particularly well limed and the pastures improved and high producing.

—C. DURING

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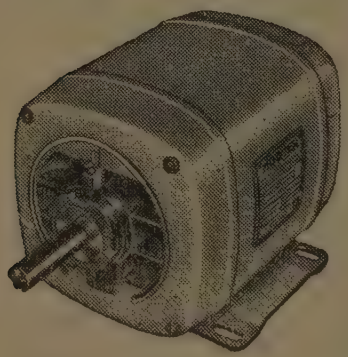

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Stacking and Thatching Rolled Baled Hay

By H. A. ARTHUR,
Fields Instructor, Department of Agriculture, Timaru

THOUGH sound-quality hay is expensive to grow, bale, and stack, farmers know how invaluable such hay can be for winter and early spring feeding. Why, then, risk having hay ruined by the weather when it is a simple matter to stack it and thatch it securely, thus making sure that it will come out of the stack in as good condition as it went in?

ON dairy farms it is easy to cart hay into a hay barn and distribute it from there to the feeding paddocks, but on large foothill farms similar to the South Canterbury one described in this article on which the stacking and thatching are demonstrated it is a totally different matter.

This farm of the Gallagher brothers comprises 1575 acres of tussock country with arable portions distributed here and there over the area. Each year 6000 to 8000 bales of hay are cut. To have one or more hay barns near the homestead would entail a tremendous loss of time in carting this large amount of fodder, especially if it was cut from a paddock at the far end of the holding.

On farms in this locality time is a vital factor during haymaking.

The Gallaghers' farm is close under the Two Thumb Range and receives a considerable number of north-west showers. Stacking the hay in the paddocks where it is cut saves valuable time.

The method of stacking and thatching is straightforward and simple and ensures that whatever hay is stacked during the day can be left overnight secure from the weather without the use of expensive and destructible tarpaulins.

As for any other stack a good site is chosen—one which is reasonably level, well drained, long enough to accommodate the stack proposed to be built, and wide enough to allow the tractor and trailer to pull in on either side.

For the building of any type of stack it is advisable to work on each side alternately, as this helps to give even consolidation to the butt.

Method of Construction

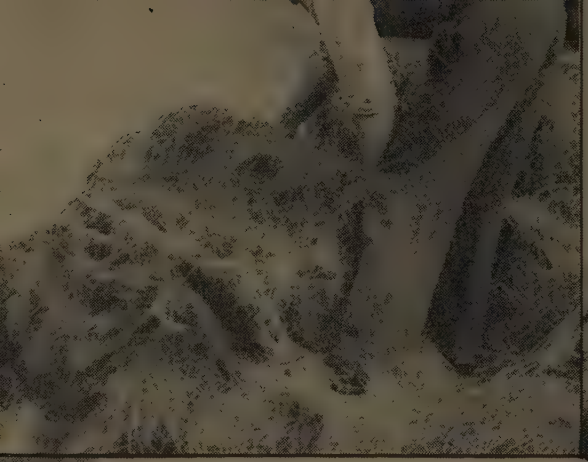
1st tier: A base is laid down consisting of four bales placed end to end across the width of the stack site and other bales are laid similarly in fours along the site of the stack for about 10 or 12 lines of bales (see ground plan on page 253.

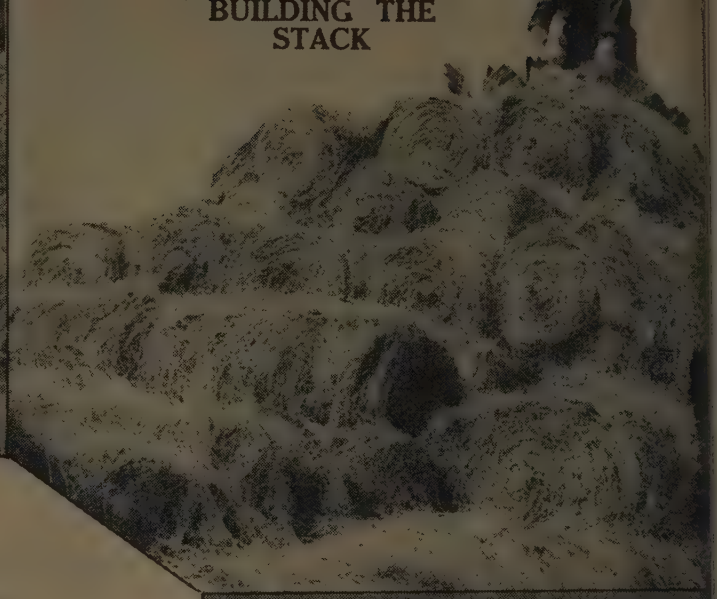
2nd tier: This tier is built the same as the 1st tier, the bales being fitted

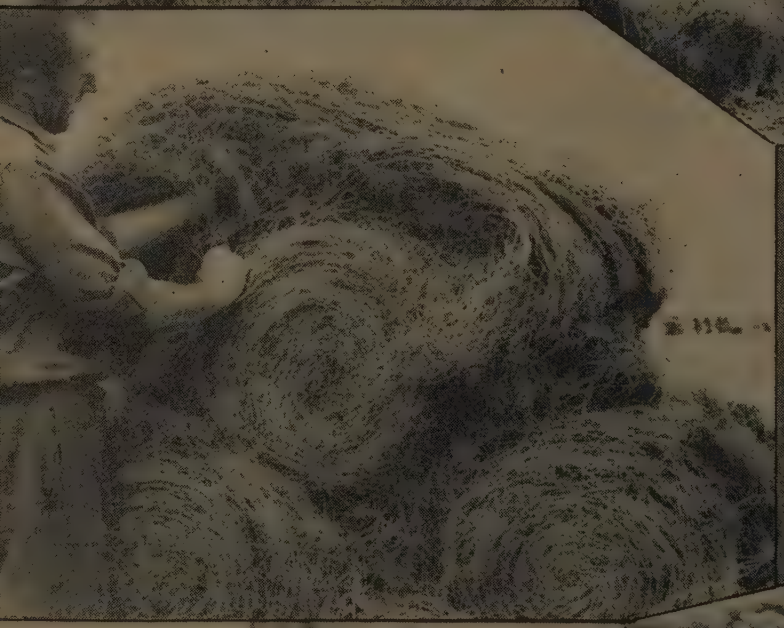
HEADING PHOTOGRAPH: A scene on the Gallagher brothers' property near the Two Thumb Range, which separates the Ashwick Flat country from the Mackenzie Plains. The trailer is used for carting in the hay and also for feeding out. The drum in the centre of the trailer is part of the bale-slicing unit. All the hay is handled with large hooks which are similar to cargo hooks and which were made in the farm workshops. An average trailer load is 106 bales.

End view of a partially completed stack. The trailer can be pulled in on either side.

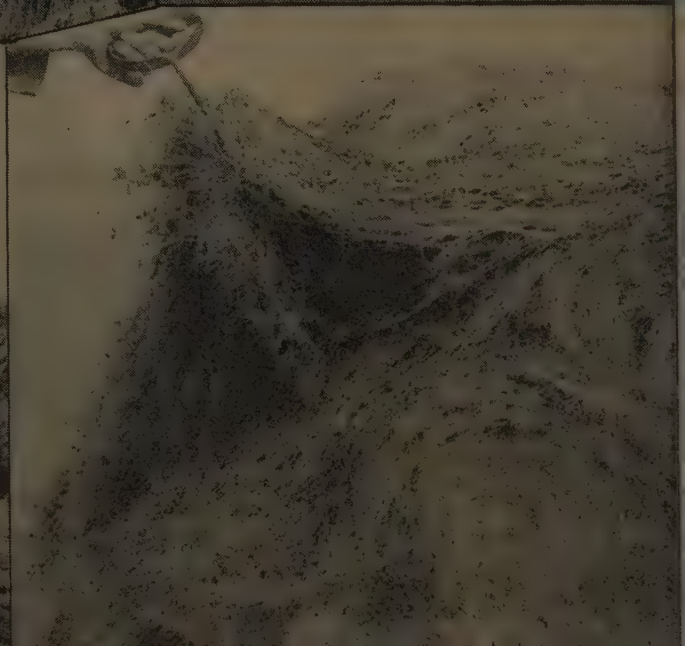
BUILDING THE STACK



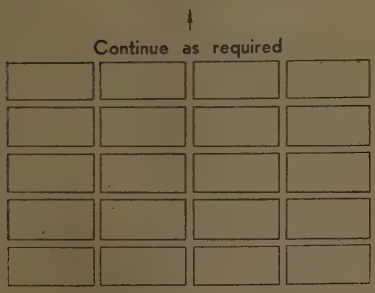




Upper left—The bale being handled has just been chopped lengthwise to a depth of about 4in. and is being turned so that the flap can be lapped down over the bale underneath it, thus forming the first layer of thatch. Upper right—Chopping a bale near the top of the head of the stack. The over and outward roll of the hay in the bales can be seen. The photograph was taken in a strong north-westerly wind, but the thatching was not badly disturbed. At left—Putting on the stook. The top bale is covered by a layer of hay made from a bale which has been cut through to the centre and then flattened out. Lower left—Lowering the thatch on to the bale immediately below. Lower right—A corner of thatch, showing how the thatch falls into place.



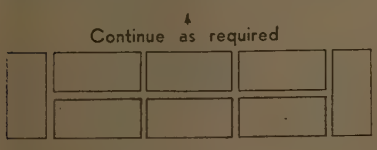
Side view of a partially completed stack. Only enough base to allow working room is laid down at one time. The overhang of the eave row is shown.



Ground plan of stack.

in the hollows between the previously placed bales.

3rd tier: This tier has the outside bales placed lengthwise along the stack with the three inside pairs of bales placed lengthwise across the stack.



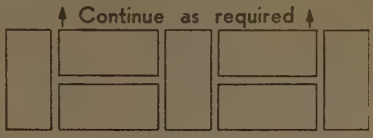
3rd and 6th tiers.

4th tier: This is similar to the 1st tier, four bales being placed across the stack.

5th tier: This is similar to the 4th tier, with the bales fitting snugly between those in the 4th tier.

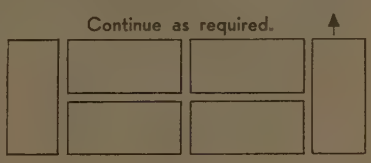
6th tier: This is the eave tier and it is made similar to the 3rd tier. The three inside pairs of bales are placed lengthwise across the centre of the stack and the outside row on each side is placed lengthwise along the stack. The centre bales can be left a trifle slack across the stack so that when the outside bales are placed in position they overhang the side of the stack slightly and act as an eave. Care must be taken not to accentuate this overhang. Even if this row is built flush with the outside, it has a tendency to come out a little.

7th tier: This is the first head tier and is built as follows: One bale in the centre is placed lengthwise along the stack. Two bales are then placed on each side lengthwise across the stack, and then one on each side is placed lengthwise along the stack. Care must be taken in placing these outside bales, because they are the first to be cut for thatch. **They are placed so that the roll in each bale comes over the top from the inside to the outside** (see diagram of elevation of stack on page 254). These two outside bales are cut lengthwise with a hay knife, axe, or tomahawk to a depth of about 6in. The easiest way is to have the bale in place and then cut along the top and turn the bale round, separating the cut flap from the rest of the bale and letting the flap down until it reaches the centre line of the eave (6th) row.



7th tier.

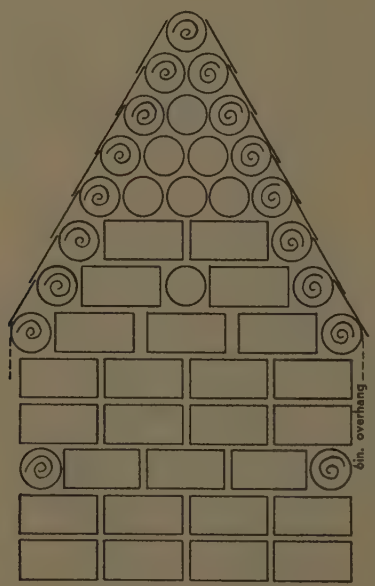
8th tier: This tier has two pairs of bales laid lengthwise across the middle



8th tier.

STACKING AND THATCHING ROLLED BALED HAY

Tied down and secure from the weather this hay will be in sound condition when required in winter. If it is not used then, it will stand perfectly well until it is required.



End elevation of stack.

of the stack and one on each side placed lengthwise along the stack. These outside bales must be placed as were the outside rolls in the 7th tier, the roll in each bale coming over the top from the inside to the outside. They are cut and turned until the flap reaches the centre line of the row directly below.

9th, 10th, 11th, and 12th tiers are built up in pyramid shape, care being taken that the outside bales are arranged to ensure that the roll in each bale comes over the top from the inside to the outside.

13th tier completes the pyramid. This bale is not cut.

To finish the thatching a bale is cut through to the centre and laid out flat. The centre short lengths of hay are rolled up and used to pack in on each side of the top bale, and the remainder is placed evenly over the top bale and brought down each side until it reaches the centre lines of the two bales below it.

As each head tier is completed and before another head tier is built the thatch should be teased out a little and spread so that all crevices are covered. A tie-down is then placed over this thatch, thus completing the operation. This process is continued along the stack as it is built; it is only necessary to have enough butt to work on to allow the stack to be left at any time with the minimum of hay unprotected.

There are several advantages to this method of stacking and thatching hay in situ. The most important is the great saving in time when, owing to limitations by weather, it is of such vital importance. A hundred bales can be carted, stacked, and thatched in an hour.

The stack can be carried on for any length or can be finished off with a couple of loads. No covers or straw are required.

The stack is watertight and if reasonable care is taken in its building, it will not split open.

The disadvantage of a very large stack would be the risk of fire. Anyone contemplating this method can build the stack with confidence, because it has been used by the Gallagher brothers with complete success. As previously mentioned their farm is situated in a wet area; besides a high rainfall there is quite a lot of snow in winter, but despite these adverse conditions the hay is kept perfectly dry.

Acknowledgment

Thanks are expressed to the Gallagher brothers for their co-operation in the preparation of this description of their stacking method.

Vacancies for Extension Workers

There are a number of vacancies for Instructors in Agriculture, Fields Instructors, and Soil Conservators in the Extension Division of the Department of Agriculture.

Though the general requirement for these positions is a degree in agriculture and experience in farming in New Zealand conditions, applications from those holding a diploma in agriculture and having a good farming background will be considered.

All recruits to the extension service receive training before being required to undertake farm advisory work, and for the first year or two carry out very interesting work such as field experiments, seed certification, and farm surveys; Soil Conservators learn the principles of soil conservation by doing field work on catchment control schemes and contour furrowing operations and carrying out general duties on soil conservation reserves.

Further particulars about these vacancies can be obtained from the nearest office of the Department of Agriculture.

A Interior of round farrowing house showing a litter in the central safety zone suckling a sow. The brooder lamp, iron guard rails, and wooden guard which prevents the litter from straying outside the house can also be seen.

Results of Farm Use of Round Farrowing Houses

THE round farrowing house was designed at Ruakura Animal Research Station with the prime object of reducing losses in pigs at farrowing time. Farm surveys reveal that 27 per cent. of all pigs born die before weaning, and overlying by the sow accounts for one-third of these losses. Since the majority of pigs lost which had a chance of survival are overlain, this problem received most consideration when the house was being designed. The round farrowing house has given very satisfactory results at Ruakura and is quickly gaining favour with many farmers. In this article E. D. Edwards, Technical Officer, Department of Agriculture, Wellington, discusses the value of the round farrowing house to the pig producer and the results which have been obtained on a number of farms in the North Island.

WHEN brooder lamps were used in orthodox farrowing houses at Ruakura losses from overlying were reduced from 8 per cent. to 6 per cent. of pigs born. All sows are now farrowed down in round farrowing houses and only ½ per cent. of pigs born have been lost from overlying by the sow. The efficiency of the house is further demonstrated by results at Massey Agricultural College piggery, where from 46 maiden sows an average of 9.91 pigs were born and 8.63 weaned. Of 451 pigs born alive the deaths of only 2 could possibly have been attributed to overlying.

The procedure adopted at Ruakura in farrowing sows in the round house is as follows. Two days before she is due to farrow the sow is placed in the house to get her accustomed to her quarters. A thick layer of wood shavings is provided for bedding and the infra-red lamp is switched on. Wooden guards are placed in the house on either side of the central baffle to prevent piglets straying outside and as long as these are in place, blocking the doorway with a light hurdle is unnecessary. In any case the provision of a hurdle at the doorway is a disadvantage in that before farrowing and immediately after farrowing the sow on many occasions will go outside to get a drink of water and in the course of this trip will both urinate and dung. If the sow is confined to the house, both these operations take place within it, which means that the floor becomes dirty and wet.

The lamp is left on for 3 days after farrowing and then the sow and litter are transferred to an orthodox house when this can be arranged.

The round house has proved quite suitable for fattening pigs to porker

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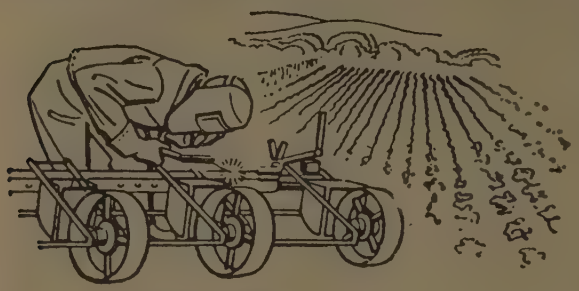

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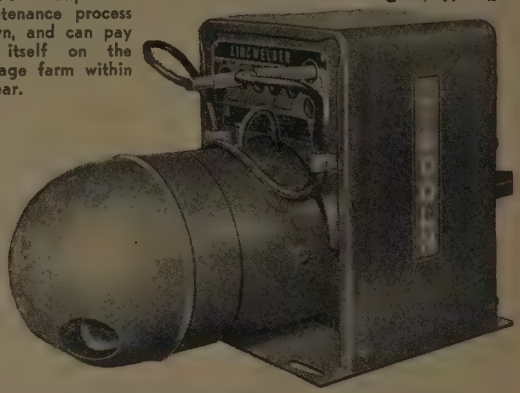

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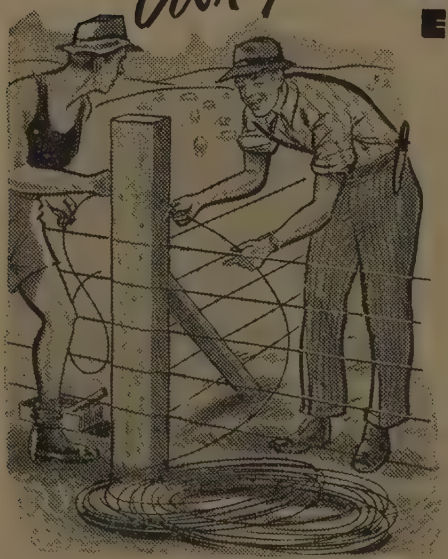

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weights when the guard rails have been removed.

An attractive feature of the round farrowing house is that usually it will be cheaper to erect than other orthodox farrowing accommodation. At present round houses constructed of different materials and incorporating various roof designs are to be seen at Ruakura and on many farms. From experience with these types of round farrowing houses a number of improvements have been made to the original design.

RESULTS ON FARMS

Waikato

One of the first farmers to build a round farrowing house was Mr. R. Sutton, of Te Rapa, near Hamilton. Before the 1953 autumn farrowings Mr. Sutton had an old, open-air, Waikato-type piggery and his losses were very high (31 per cent.) under these conditions. To remedy this he built 6 dual-purpose houses on the lines of the recently designed Waikato-type house and one round house of the prototype design illustrated at right. His intention is to farrow as many litters as possible in the round house and the rest in a dual-purpose house.

For his own information and with the assistance of Mr. J. Taylor, Waikato District Supervisor of the New Zealand Pig Producers' Council, Mr. Sutton recorded the details of the 1953 winter litters (six in each house) to see how the two houses compared. The results showed that in the round house approximately one more pig per litter was weaned than in the dual-purpose house. Unfortunately the details recorded are not available now.

However, an examination of Mr. Sutton's farrowing records since 1953 shows (where the house used for farrowing each litter could be traced) that in the round house only 2 per cent. of pigs born were overlain and in the dual-purpose house 3 per cent. of pigs born were overlain, compared with 31 per cent. of losses in the original layout. Details for the litters farrowed in each type of house, together with those of litters which could not be identified but the majority of which would have been farrowed in the round house, are as follows:—

House	No. of litters
Round house	11
Dual-purpose house	8
Not known	33
Old piggery	22

All maiden sows are farrowed in the round house if possible, because Mr. Sutton considers that sows settle down much quicker in it than in his dual-purpose houses when they are confined before farrowing. Farrowings are observed whenever possible, and Mr.

Mr. R. Sutton, of Te Rapa, has a round farrowing house similar to this prototype house at Ruakura, the roof of which has not proved satisfactory.

Sutton believes the round house to be safer, because the sow can be approached from the rear within the house.

Precautions are taken to prevent the sow farrowing in the yard and to stop the litter straying. A reminder of the importance of this occurred once when the door fixed to the entrance of the house was left open when the sow was due. The following morning three piglets were dead behind the door in the yard. The wooden guard rails were not in use at the time.

An infra-red brooder lamp is used for 3 days after farrowing. If the weather demands it, an ordinary 100-watt light bulb is used after this. The cost of using the lamp in this manner is about 7s. 6d. per litter.

When the round house is needed urgently for another farrowing Mr. Sutton transfers the sow in it to a dual-purpose house only after she has had two feeds. He first puts the litter under the lamp in the dual-purpose house an hour before moving the sow, because when transferred she continues to lie with her udder to the centre of the house and usually has her back to the protected area. In this way the piglets immediately learn where they will be safe. When the litter transferred is older the lamp is used for about 5 hours only. The brooder lamp is also used when sows farrow in the dual-purpose house, being considered essential in that type of house.

No. of pigs per litter Born	Weaned	No. of pigs overlain as per cent. of pigs born
8.6	7.0	2
8.5	6.6	3
9.2	8.1	—
—	—	31

Meal self-feeders are used as soon as litters will take supplementary foods.

Cleaning out of the round house is done daily and at this time sows are allowed out to graze for 1 hour. The litter is allowed out with her when they are 1 week old. As bedding in the house Mr. Sutton has used shavings for 3 years. Until this year only a thin layer was used and this had to be replaced every third day, as it got wet and this led to arthritic conditions in the pigs. This year a deep-litter system has been followed, a bag of shavings being added 3 weeks after farrowing. The results are much drier conditions, improved health of the pigs, and less work in cleaning out.

Mr. Sutton, who has 10 sows, believes that one round house should be sufficient for the average farmer, as it is not as convenient for fattening as the dual-purpose house in use on many farms today. His round house has 4in. thick concrete walls and a nearly flat roof of two sections. Sheet iron and softboard lining are used in the roof. In hot weather one section of the roof is propped open against the wall, and it is stated that this prevents the house becoming uncomfortably warm.

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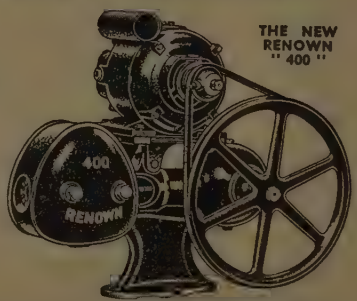

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also as a feeding race. The corrugated iron roof over the sleeping floor of one house extends over the central race to meet the roof of the opposing house. The roof is lined with soft-board above the sleeping floor. Walls are of 4in. thick concrete 3ft. high and there is a creep area under cover between the sleeping floor and race. As in the round house the floor consists of a concrete base on which is a 2in. layer of coke breeze concrete sealed with plaster. Air space is restricted to a minimum in the house by having the roof 2ft. 10in. high inside at the back and 4ft. 7in. at the front of the sleeping floor.

Though the dual-purpose houses provide farrowing accommodation of a high standard, Mr. Sutton prefers to use the round farrowing house for that critical period when piglets may be overlain.

Plastered Round Farrowing Houses

Mr. E. Koerbchen, of Huntly, has had two plastered round farrowing houses in use since May 1954. The houses are of the type have a peaked roof 6ft. high at the entrance. Mr. Koerbchen and his son built the two houses complete with yards and a tiled drain to a nearby creek for a material cost of £82.

About 15 years ago an enclosed house containing 5 units was built for both farrowing and fattening. In 1952 electric brooder lamps were used in these units to cut down farrowing losses. Details of all litters born since 1952 are as follows:—

House	No. of litters	No. of pigs per litter Born	Weaned
Round house ..	22	9.6	8.4
Dual-purpose house	14	8.5	7.2

There were no losses from overlying, but many hours were spent at night in the dual-purpose house attending sows because piglets often strayed from their mother and would sometimes die at the far end of the pen, even though a lamp was used in one corner of the sleeping floor. To prevent these losses someone had to be on hand to place the piglets under the lamp and so teach them to use this safety area.

Each unit in the dual-purpose house is 7ft. x 14ft., with a continuous fall on the floor from back to front. Along one side is a 7ft. trough protruding through the end wall, the opening in which is a favourite and sometimes final exit for piglets on many farms beside this one. Units are separated by dwarf concrete walls and the iron roof is approximately 6ft. high at the back and 8ft. over the enclosed feed race at the front. To provide warm conditions in winter for young pigs was difficult in this house and, besides the lamp which was used for several days after farrowing, a false ceiling made with hay over wire netting was erected over the sleeping floors. In addition, hay bedding was provided.

Round farrowing houses in waterproofed, reinforced concrete at Mr. A. East's piggery, Woodville. They have a 6in.-diameter controllable roof vent and 4ft. high entrance. The self-feeder is an experimental model.

Now, with the two round houses, farrowings are much less troublesome. Sows are put into the houses 10 days or a fortnight before they are due and lamps are switched on about 4 days before litters are expected. A thin layer of shavings is now used for bedding and this appears to be satisfactory under the management on this farm. It does not get too wet and no troubles in the piglets have been attributed to its use.

When the sow is near to farrowing she is confined to the house in the following manner: Two iron rods are placed in position extending from the central baffle to each side of the house at a suitable height to prevent the sow from getting out. This also prevents piglets at birth from being dropped outside the wooden barrier (about 1ft. nearer the door) which is used to stop piglets from straying. This arrangement of the sow and litter barriers is a sensible precaution, because if only the litter barrier were used, it could sometimes cause deaths of piglets.

Visits are made to check on progress of farrowings, but long periods are not spent on watching farrowings as was necessary before the use of round houses. The fact that, on the average, one more pig per litter is being weaned than in the old house shows their value to Mr. Koerbchen.

The lamps are used for only 4 days after farrowing and as soon as the litter is strong enough it is allowed out with the sow on pasture. As a result the floor of the round house requires very little attention. The piglets have access to creep feed whenever they want it.

There are 10 sows on the farm and farrowing dates are arranged so that each sow will farrow in a round house and spend several weeks in it with her litter. Mr. Koerbchen claims that these houses do not get too hot in summer. With sows and litters using them most of the time and getting a liberal run-out this can be expected. If fattening pigs were confined in round houses of this type, there is reason to believe that the houses would get too hot during warm weather. However, at times as many as 11 stores have been housed in a round house by removing the baffle and these pigs all appeared to be comfortable.

On Mr. Koerbchen's farm pigs have always been well cared for, being given as much attention as normal farm work has permitted, yet the two round farrowing houses have improved past results and made pig management much easier.

Southern Hawke's Bay

Last autumn a new piggery was built on the property of Mr. A. East, Hopelands, Woodville, and is being managed by Mr. J. Gilliland. There are four round farrowing houses of waterproofed concrete, which, with a Harper Adams-type fattening house form a very compact layout.

[*Niederer*

Some of the types of round farrowing houses on trial at Ruakura.

The old piggery consisted of 5 units having 8ft. x 8ft. concrete sleeping floors and feeding yards. Each had timber above dwarf concrete walls and a corrugated iron roof. The piggery was badly sited and was cold, draughty, and quite inadequate to cope with the steadily increasing supply of skimmed milk available in recent years. Though no figures had been kept on farrowing performances under these conditions Mr. Gilliland states that it was common to lose 50 per cent. of the pigs born before weaning. Many of the pigs were overlain.

Eight sows have now farrowed in the round houses, the average litter being 8.8 pigs born and 7.7 weaned. Mr. Gilliland is certain that no piglets have been overlain.

At least 10 days before a sow is due to farrow she is put into a round house to get her accustomed to the conditions, and about 2 days before she is due a kerosene brooder lamp is turned on. The lamp is left on for a week or 10 days, depending on the weather.

While she is farrowing the sow is shut in the house by a pipe gate. The gate is hung from the side of the house and is curved to the line of the wall to which it is locked. When the gate is not required to close the house it can be fastened to the pen gate post and then protects the self-feeding creep area from the sow. The self-feeder, which was designed by Mr. A. Campbell, Supervisor, Wellington District Pig Council, has a trough protected by lids which the pigs soon learn to lift up. Meal cannot be affected by weather or eaten by birds or rats. Mr. Gilliland is very satisfied with the self-feeder, which is reasonably priced.

A wooden barrier is used to prevent piglets from straying away from the warmed zone in the house. During farrowing and later while pigs are still quite young every opportunity is taken to check the progress of the litter. Though the butterfly valve in the roof vent can be adjusted from outside or inside the house, Mr. Gilliland prefers doing it from inside, because in this way a better idea of the warmth of the house can be obtained and any sick pig inside the house will be noticed.

For bedding 2in. to 3in. of wood shavings are put in before farrowing and more are added later as thought necessary. Occasionally, when the bedding gets too wet, it is cleaned out and replaced. All yards are cleaned daily.

Weaning

The age at which pigs are weaned depends on their progress, but usually weaning takes place when they are about 1 month old. Before this, sow milk-replacer pellets are available in the self-feeder as soon as the piglets will take them. After weaning a grain meal plus some buttermilk powder is used for 3 weeks, which is then followed by a ration of barley meal only, and about this time the pigs are moved into the fattening house. While on the sow the litter has access to milk in the sow's trough. After weaning the milk is fed carefully to avoid scouring if possible. This method has produced a group of pigs averaging 48lb. at 8 weeks. At weaning pigs are divided into two groups according to size when this is practicable.

With 14 weaners in the round house in warm spring weather, air temperature inside has reached 75 degrees F. Though this is the recommended level for pigs of this size, the pigs preferred sleeping in the yard in the sun. The butterfly valve in the 6in.-diameter roof vent is kept wide open in warm weather. Mr. Gilliland intends keeping a record of the daily range in temperature in summer in the round farrowing house and in the Harper Adams house to see how effective these houses are in maintaining a suitable environment for pigs.

At present Mr. East has 70 cows and 10 sows, and it is planned to supply a local butcher with porkers throughout the year if possible. Barley and root crops will be grown to supplement the skimmed milk available, and this farmer is confident that with his new houses the scheme will be a success.

Conclusions

The round farrowing house was designed to assist farmers to reduce losses in young pigs. Results at Ruakura Animal Research Station and Massey College had proved its effectiveness in preventing the overlying of baby pigs by the sow, but how effective the round house would be under farm conditions had yet to be shown.

Dozens of farmers now have round farrowing houses, built by various methods and with different materials. The experiences of three mentioned in this article suggest that the round house will be equally effective on other farms when used properly. In addition to saving piglets these houses can mean a saving in time to many farmers when sows are farrowing. The houses, provided they are not of one or two of the early versions, are not difficult to manage.

The feature which still lends itself to experiment is the material used in the house. Greater insulation is desirable and in this respect the roof is most important, as it affects not only the warmth of the building but ease of management. This difficulty should soon be overcome.

Plans of round farrowing houses are available from offices of the Department of Agriculture and local supervisors of the New Zealand Pig Producers' Council.

A Small Converted Boiler for Beekeeping Work

ONE of the early problems of honey house equipment every beekeeper has to solve is an adequate supply of steam for his uncapping knife and other heated fittings. This article by L. J. S. Line, Apiary Instructor, Department of Agriculture, Hastings, describes a small boiler that can be made from a discarded fire extinguisher and which will supply most beekeepers with all the steam they require.

COMPARATIVELY few commercial beekeepers require large boilers producing approximately 2 h.p. of steam to supply heat to a cappings melter, uncapping knife, washing sink, honey tanks, or hot room. However many beekeepers with from 10 to 300 hives would find the smaller type of boiler described below both efficient and economical to operate; often it can be bought for only its cost as scrap metal.

This boiler is built from the body of a 2-gallon fire extinguisher. To be satisfactory as extinguishers these containers have to hold a chemical preparation under high pressure, 350lb. per square inch, without showing any defects. If they fail to reach this high standard when tested by fire brigades, they are discarded.

By keeping in touch with a fire brigade a beekeeper should be able to obtain a unit which is in good condition for his purpose. Copper extinguishers should be used, because steel ones are likely to be severely corroded and therefore dangerous for use as boilers. As some extinguishers are only copper-plated steel, care should be taken to see that the body is all copper. As beekeepers need to operate the boilers made from extinguishers at a pressure from 2lb. to 20lb., there is therefore a very large margin of safety.

Fig. 1—A typical fire extinguisher which is discarded when defects appear at a pressure of 350lb. per square inch but which is quite serviceable for beekeeping purposes, for which a pressure of up to 20lb. is required.

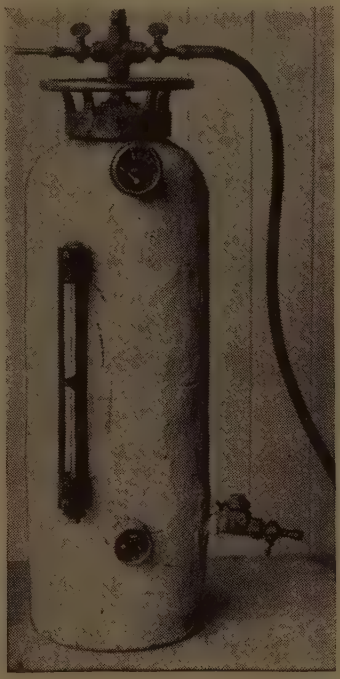


Fig. 2—An old fire extinguisher fitted with a 1500-watt kettle element, delivery valve, water gauge, steam gauge, and in the movable head a connection for 2 gas lamp taps. Because gas taps may jam when hot, steam valves are better, and a safety valve should be fitted in place of the screwed plug on top of the T connection.

Fittings Required

The fittings which require to be attached to the cylinder are an electric kettle element (close to the bottom) and then a water gauge glass. To prevent the element from being burnt out the bottom nut of the gauge glass should be above the highest part of the element. Up at the top from the exit pipe is fitted a steam pressure gauge having a range of at least one and a half times the working pressure, a safety valve which will prevent the pressure from building up to more than 10 per cent. above normal, and the taps which lead the steam to the uncapping knife and the water of the cappings melter. This melter usually requires an auxiliary heating element to melt the cappings properly.

The boiler shown in Fig. 2 has gas lamp taps fitted to a T connection in the movable head. As gas taps are likely to jam when hot, the use of steam valves is preferable. A close-up view of the arrangement of the taps is given in Fig. 3. An alternative arrangement is shown in Fig. 4, where steam valves are used and the fittings are placed on the side of the boiler instead of on top. This has the disadvantage that in this position the fittings are more likely to be damaged than if they were placed on top as in Fig. 2.

On the lower right of the cylinder shown in Fig. 2 is a delivery valve to which a stirrup pump is connected for pumping back hot water when the level gets low. The boiler shown in Fig. 4 has no delivery valve, the water being sucked back by the power being switched off and the temperature in the cylinder dropped, which causes a vacuum. To do this the tap to the uncapping knife is closed and the tap to the melter is kept open.

The water gauge glass is the type supplied with hot-water urns used in restaurants. The movable head piece covers an opening large enough for the fitting of the electric element, and this head piece should be fitted with a tough rubber-canvas washer to prevent escape of steam. Lead washers are not as efficient as the rubber-canvas in preventing the escape of steam around the top shoulder.

Fig. 3—The fittings in the movable head of the boiler shown in Fig. 2.

Fig. 4—An alternative arrangement of fittings to that in Fig. 2, the fittings being placed on the side of the boiler. In this position, however, they are more likely to be damaged.

Lagging

As these copper cylinders radiate considerable heat, plastering the surface with the type of asbestos meal used for boiler lagging is advisable; a thickness of 1in. is sufficient. The lagging on the boiler in Fig. 2 has received a protective coat of paint, and on that in Fig. 4 a sheet of tin has been fitted round and clamped tight with small bolts down a seam.

The water gauge in Fig. 4 is recessed in the lagging, but that in Fig. 2 is protruding. The latter position probably allows the lagging to be plastered on more easily.

The electric element should preferably be 1500 watt, and a beekeeper using this type of boiler can usually extract about 1 ton of honey a day.

Before being used for beekeeping work the converted boiler should be subjected to a hydraulic test at double the working pressure.

Choice of the stirrup pump or vacuum method of refilling the boiler will depend on whether the beekeeper can do other jobs while the vacuum-filled cylinder is again building up pressure. Feeding the boiler by stirrup pump is the more satisfactory arrangement.

Being compact and satisfactory in giving the necessary heat and pressure, this type of boiler would be a very efficient unit in most beekeepers' honey houses.

Time Factor in Tractor Tipping

NOT many tractor drivers realise how little time there is to react and take remedial action once a tractor has started to tip. This article by C. M. B. Olivecrona, Machinery Instructor, Department of Agriculture, Wellington, which is based on experiments carried out in the U.S.A., points out the narrowness of the time margin between safety and danger once a tractor has started to tip.

SOME interesting experiments were carried out in the U.S.A. recently with the object of finding out how fast a tractor does tip or rear when it is badly hitched to a load or when the clutch is engaged too suddenly while a heavy load is being pulled. The results of these experiments showed fairly conclusively why so few drivers escape injury or death once a tractor has started to rear. They also revealed other potent factors in the backward upset of tractors which, though realised by many drivers in a general way, cannot be appreciated fully for the dangerous factors they are until expressed in terms of time.

1. It was found for instance that a tractor would tip to the point of instability in 1.36 seconds.

2. The critical angle of a tractor can be reached in 7/10 second. (The critical angle is the point at which the disengaging of the clutch could not prevent an upset.)

3. Rapid engagement of the clutch gave greater initial acceleration and a smaller critical angle, but the total tipping time was about the same regardless of the method of clutch engagement.

4. The amount of power required to raise the tractor's centre of gravity to a point of instability dropped very rapidly as the front wheels rose. This showed the danger of careless operation when a tractor is started on a hillside or loaded front end first on to a truck.

5. Tractors with a hitch point that lowered as the front end of the tractor rose were not as dangerous as those with the hitch point near the axle which did not lower as the tractor rose.

6. As long as there was sufficient torque to tip the tractor the gear used did not greatly affect the total tipping time.

7. The time available to an operator to take action for safety once he realised that the front end was rising was about 4/10 second. It was also established that a tractor with a high horsepower : weight ratio would tip faster than one with a lower ratio of horsepower to weight. Most modern tractors have a high horsepower : weight ratio, because they are better designed and more efficient than older models.

Incorrectly hitched tractors or those that have weight badly distributed between chassis and wheels would tip even more quickly than did those used in the experiments in the U.S.A. The experiments dealt only with backward tipping.

Farming on the Wairarapa Plain

THE new railway tunnel route between Wellington and the Wairarapa is now open and increased interest is expected to be taken in the economic development of the Wairarapa Plain. To obtain information on the farming systems on the plain and the production capabilities of the different soil groups a farm management survey was made in May 1954 by G. Mason, Farm Management Research Officer, Department of Agriculture, Christchurch, and A. Pantell, formerly Farm Management Research Officer, Department of Agriculture, Palmerston North, and in this article G. Mason gives some of the results of the survey.

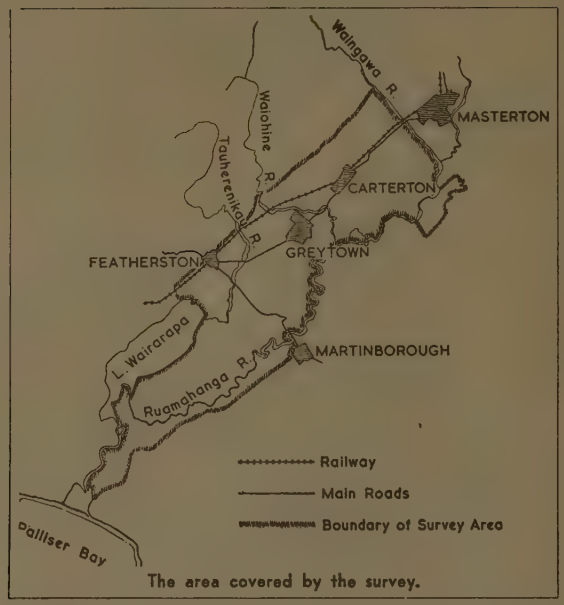
THE part of the Wairarapa Plain covered in the survey is that area south of the Waingawa River extending to the coast at Palliser Bay and with the foothills of the Tararua Ranges forming the western boundary and the Ruamahanga River forming the eastern boundary. It comprises portion of the three counties of Masterton, Wairarapa South, and Featherston. The total acreage within the survey is approximately 150,000 and the farms from which information was obtained covered 19,000 acres.

HEADING PHOTOGRAPH: A view toward the north from Featherston showing the foothills of the Tararua Range rising steeply from the plain. Whites Aviation photograph.

History of Settlement

Natural vegetation was no hindrance to development in the area, as it was in many other North Island districts, as the Wairarapa Plain was mainly covered with tussock and fern with patches of matai and kahikatea. Also there was little friction between Maori

Location of the Wairarapa Plain.



The area covered by the survey.

and pakeha. However, early settlement was hindered by the difficult access to and from the port of Wellington.

Robert Stokes, Charles Kettle, and Samuel Brees were explorers in the area in the early 1840s and settlement soon followed, with Charles Bidwill the first settler to establish a flock of sheep in the district, this being at Kopungarara in 1844. Charles Clifford, William Vavasour, Frederick Weld, and Henry Petre rented land from the Maoris shortly afterward and by 1847 there were approximately 2000 cattle and 13,000 sheep in the district.

Closer settlement of part of the plain began in 1853 when a group promoting small farm settlement led by Joseph Masters bought from the Government land near Masterton and Carterton and settlers each took up 40 acres of rural land and a town acre. However, rural development was spasmodic until the railway from Wellington to Featherston was opened in 1878, and this and the development of the frozen meat trade gave impetus to farming in the district.

Natural History

The Wairarapa Plain has been formed partly as a result of great land upheavals along a well-defined fault line where the Tararua Ranges rise steeply from the rolling and flat country. The formation of the plains has been completed by alluvial deposits brought down chiefly from the mountains. The resulting basin drains both to the east and south, three major rivers flowing across it, the Tauherenikau, the Waiohine, and the Waingawa. The last two rivers join the Ruamahanga River on its course along the eastern border of the plains, finally emptying into Lake Wairarapa in the south.

Climate

The climate of the plains is suitable to pastoral and fat lamb farming on the free-draining soils and to dairy farming on the slow-draining, fine textured soils.

The Tararua and Rimutaka Ranges to the west shelter the plain from the north-westerly rains, the highest precipitation being recorded along this western boundary. The rainfall decreases toward the centre of the plain and increases toward the eastern hills. Featherston, at the foot of the Rimutaka Range, has an annual average fall of 51in., Greytown has 42in., and Martinborough, toward the east, has 29in. Most of the plain has a rainfall of between 30in. and 40in. The rainfall distribution is somewhat irregular with a winter maximum (May to August). Late spring, midsummer, and autumn are the low-rainfall periods with January the most critical month owing to the hot, drying winds common at that period.

The dry summer makes it necessary for sheep farmers on free-draining soils to quit their stock early in the season, and it also has a considerable effect on the seasonal production and the conservation of fodder as hay or silage for winter feed.

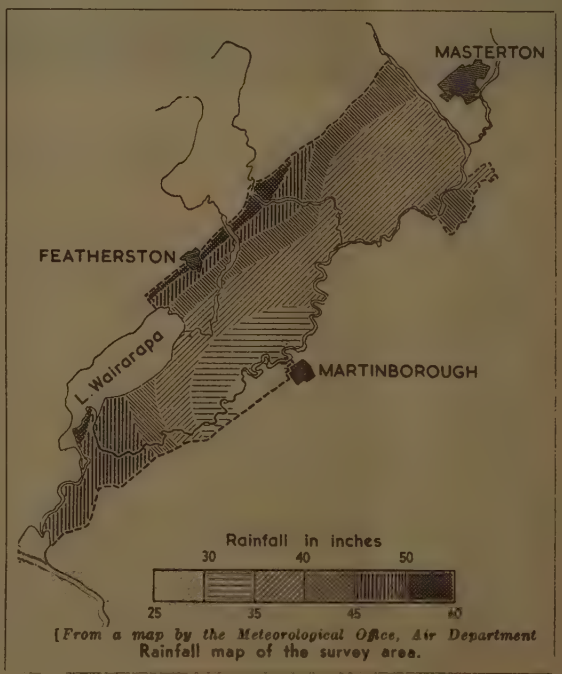
The annual variation of temperature is fairly high by New Zealand standards, being approximately 19 degrees F. for Masterton, which has the highest average monthly figure of 63.3 degrees F. for January and its lowest of 44.3 degrees F. for July. Here ground frosts are recorded for approximately 106 nights during the year and though they are most frequent between April and October, they may occur in any month. July and August, when low soil temperatures, frequent frosts, and high soil moisture content bring pasture growth almost to a standstill, are the most critical for the wintering of stock.

Pastures are liable to become pugged with the trampling of cattle at this time of the year and dairy farmers generally find it necessary, especially on the deeper, slow-draining soils, to remove their stock over this period and avoid damage to pastures.

Soils

The soils on the plains are formed from alluvium, built mainly by erosion of the greywacke ranges. Most of these soils, particularly in the west, are free draining with large areas which are stony and bouldery.

In the east, however, the subsurface flow of water through the underlying strata of permeable gravel has been impeded by long, narrow ridges of greywacke material which run almost parallel with the eastern boundary of the plain and project above the alluvial gravels. The result has been the formation of gley soils of poor structure which present serious drainage problems in their development.



[*From a map by the Meteorological Office, Air Department*
Rainfall map of the survey area.

The main problem area extends from Morrisons Bush through Kaiwaiwai to the outlet of the Tauherenikau River into Lake Wairarapa.

A similar ground moisture effect has influenced the formation of the soils on the eastern side of Lake Wairarapa (a lake formed by the damming of the Tauherenikau River by debris carried down by the Ruamahanga River), which by rising when its outlet to the sea is blocked raises the water-table of a considerable area of surrounding country.

For this description the soils have been grouped into four major divisions, those of the river flats, stony plains, swampy terraces, and undulating lands.

Soils of the River Flats

The river flat soils comprise the areas that have been formed by recent flooding and consist of silty, sandy, or gravelly soils. They are being added to continuously by fresh alluvium and are generally rich in nutrients. They comprise:—

(a) **Free-draining** soils used for fat lamb and dairy farming. On these soils the carrying capacity on the surveyed sheep farms ranged from 3 to 4½ ewe equivalents per acre and on the surveyed dairy farms the butterfat production per acre ranged from 125lb. to 170lb.

(b) **Slow-draining soils** used mainly for dairying, on which the butterfat production per acre ranged from 130lb. to 190lb.

Soils of the Dry, Stony Plains

The soils of the dry, stony plains consist of shallow silt loams over gravel and stones and analysis shows them to be generally medium in phosphate and potash, low to medium in lime, and with evidence of low cobalt in parts. They are free draining and are subdivided into:—

(a) **Grey shallow soils** which dry out in summer and are used predominantly for sheep fattening. They are unsuited to dairying unless irrigated. Carrying capacities of between 3 and 6 ewe equivalents per acre were recorded.

(b) **Brown shallow soils:** These soils do not dry out excessively and are used for dairying and sheep fattening. Butterfat production ranged from 125lb. to 190lb. per acre.

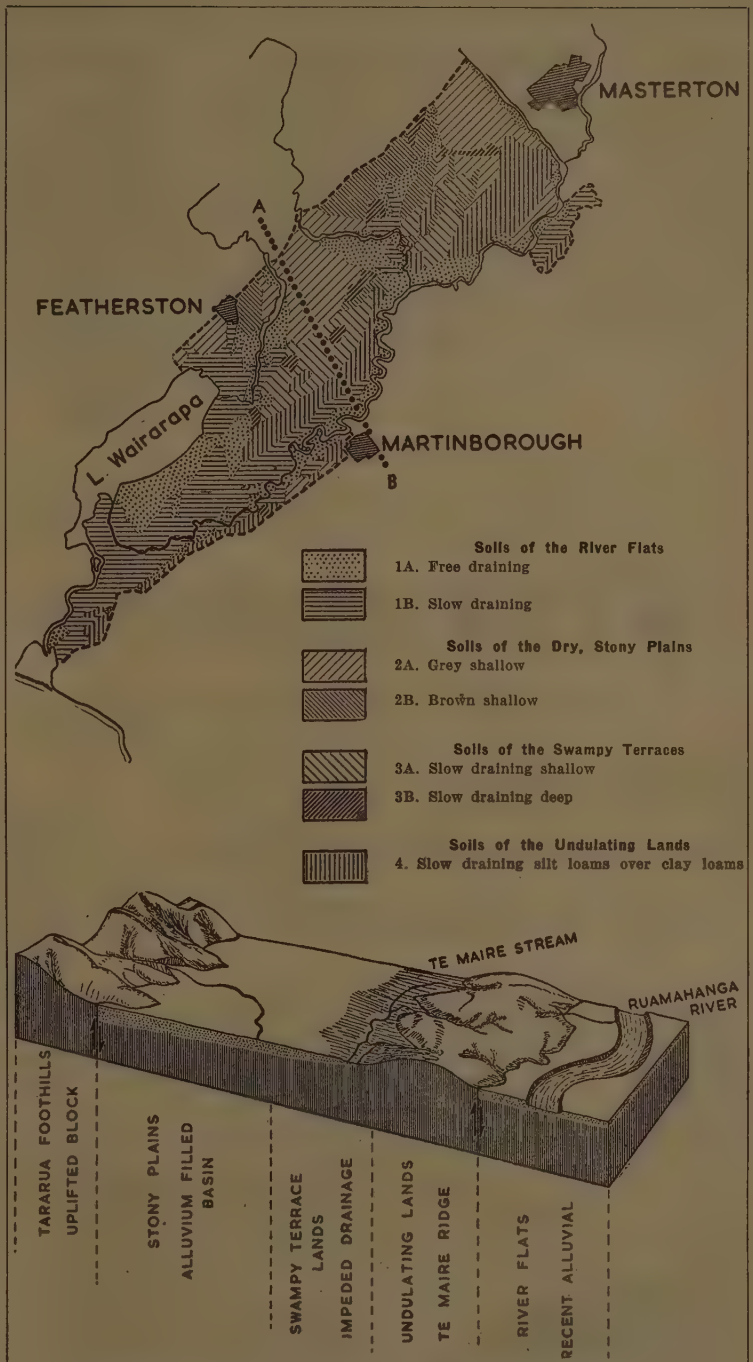
Soils of the Swampy Terraces

The soils of the swampy terraces comprise areas which have been formed under a permanent regional water-table owing to impeded drainage across the plain or to cementation of the underlying gravels. Analysis shows them generally low in phosphate, potash, and lime. They comprise:—

(a) **Slow-draining shallow soils** used mainly for dairying, with butterfat production ranging from 90lb. to 272lb. per acre.

(b) **Slow-draining deep soils** used mainly for dairying, with butter-

SOILS OF THE WAIRARAPA



[*From a map by the Soil Bureau, Department of Scientific and Industrial Research, Wellington*

Soil map of the survey area. The line A—B indicates the position of the cross section in the diagram below showing relationship of soils to topography.

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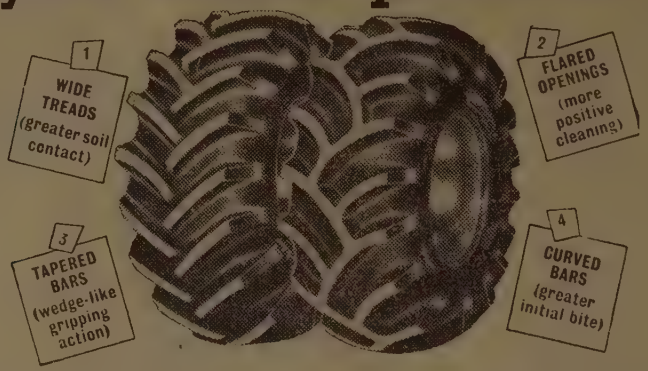

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[*Alexander Turnbull Library*

An early view of the Rimutaka road to the Wairarapa showing horse wagons ascending from the Wellington side. This route was opened for wheel traffic in 1856.

fat production ranging from 125lb. to 210lb. per acre.

Soils of the Undulating Lands

The soils of the undulating lands consist of silt loams over compact clay loams. Drainage is slow, but soils sometimes dry out in droughty periods. Sheep fattening is the main feature of these areas and there is some dairying. Carrying capacities ranged from 3 to 6.5 ewe equivalents per acre and butterfat production ranged from 105lb. to 185lb. per acre.

Present Transport

The Wairarapa has a good road transport system which handles efficiently all internal transport. The district is accessible from two directions by road and rail. From the north comes most of the heavy farm requisites, and most of the outward-bound freight, a considerable proportion of which is destined for the port of Wellington, goes by the southern route through the recently opened tunnel. Rail transport plays the greater part to and from the area.

The effect of the new railway tunnel on transport is considerable. It shortens the route to Wellington by 9½ miles and the travelling time between Wellington and Featherston is reduced by approximately 2 hours. The physical limit to the weight of goods trains which could be taken over the Rimutaka Incline route and the time taken to make the climb to the summit and in changing the special Fell engines limited the volume of goods transported per unit of time over this route to approximately one-twentieth of that which is now possible through the tunnel.

For some years it was necessary to divert about 25 per cent. of south-bound rail traffic via the Manawatu Gorge to Wellington, a route which is approximately 90 miles longer than the former Rimutaka Incline route. All south-bound traffic can now go through the tunnel and some trains from the east coast can use this route and thus reduce the congestion of rail traffic on the line between Palmerston North and Wellington.

The general stimulus to economic activity as a whole which will result from the improved access to the district must also have an effect on the development of primary production. The tunnel brings the Wairarapa, a potential supply area for vegetables and whole milk, closer to Wellington and surrounding urban areas both in distances and time. Future expansion of urbanisation around Wellington and in the Wairarapa will most likely create greater demands for fresh foods and milk.

River and Flood Control and Drainage

The problems of drainage and of river and flood control are drawbacks to the ultimate development of the district.

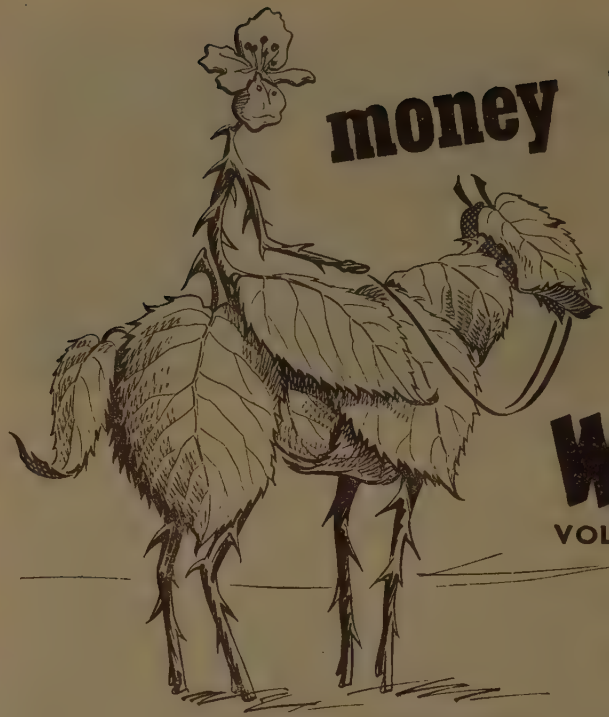
In south Wairarapa the flow of the two rivers, the Ruamahanga and the Tauherenikau, is retarded by alluvium deposits near their outlet to the sea restricting drainage over considerable areas further north. The Wairarapa Catchment Board has done some river and flood control work and greater interest is being shown in a co-ordinated scheme as benefits from a reduction in flooding become obvious. Of importance too are the flood control and drainage schemes implemented by private individuals. E. C. Holmes and E. R. Bidwill are pioneers in the pump drainage of this area.

The area where this work is being undertaken has a milder climate than most of the Wairarapa, being less exposed to damaging winds and having fewer frosts, and some of the soils have a high potential for fat lamb farming and dairying.

Drainage problems are mostly confined to the eastern side of the plain

[*D. Cross*

Before the Rimutaka Tunnel was opened rail traffic had to pass over the Rimutaka Incline, up which it was hauled by Fell engines, four of which are shown here pulling a sheep train.



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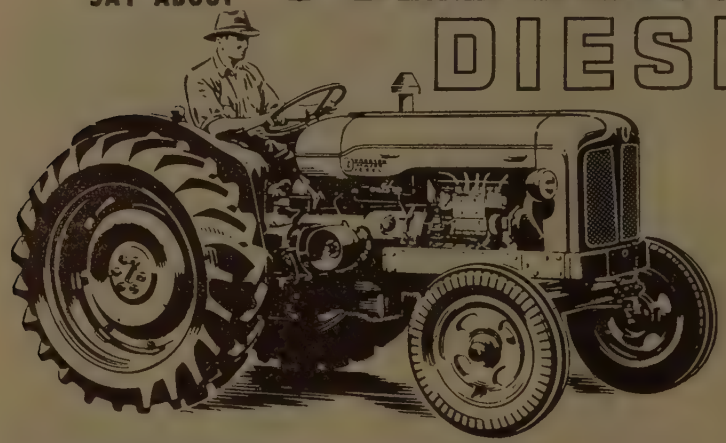

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and arise from two main causes. First, the undulating areas east of Carterton bordered in the main by Carters Line and the Ruamahanga River have a perched water-table owing to the compacted nature of the subsoil. Drainage may readily be effected by tile and mole draining, gradients and outlets usually being no problem on this gently rolling country. Much of the area has already been drained.

Second, east of Carterton and running approximately through Parkvale and Waihakeke, south of Greytown extending from Morrisons Bush through Kaiwaiwai to the outlet of the Tauherenikau River into Lake Wairarapa, and bordering the eastern shores of Lake Wairarapa there are areas of gley soils which have been formed under a permanent regional water-table. Drainage is effective only when the water-table is lowered over an extensive area by a system of wide and deep drains running through these affected areas and having suitable outlets either into the major rivers or into Lake Wairarapa. The area bordering the eastern shore of Lake Wairarapa has a high regional water-table caused by the high level of the lake, and the development of these often highly fertile, alluvial soils requires a different solution: The area has to be enclosed by stopbanks and have a reticulated open drainage system linking up with pumping stations where the water is carried over the stopbanks. These areas of high regional water-table have yet to be developed on a large scale, though some progress has been made by individuals.

These drainage problems make it necessary for some Wairarapa farmers to spell their farms during winter to avoid pugging of soil and pasture damage. Adequate drainage of these areas should ultimately result in a considerable increase in primary production in the Wairarapa.

That flooding and drainage problems are very real in the district is shown by the fact that of the 77 farms which were covered in the survey 18 were subject to flooding, 14 were recorded as having poor drainage, 22 had fair drainage, and 41 had adequate drainage or no drainage problems.

[*National Publicity*

Opening the outlet of the Ruamahanga River to the sea lowers the level of Lake Wairarapa and reduces ponding on a large area bordering the lake. A sea bar restricts this opening after heavy seas from the south.

TABLE 1—NUMBERS AND AREAS OF THE FARMS SURVEYED

	Farming system			
	Dairy	Sheep	Mixed	Total
Number of farms ..	43	24	10	77
Total area (acres) ..	4,644	11,591	2,727	18,962
Average area (acres) ..	108	483	273	246
Per cent. of total area of sample	24.5	61.1	14.4	100.0

Farming Systems

In the area surveyed the predominant systems of farming were dairy farming and sheep farming for fat lamb production. In addition small areas were used for market gardening, mainly confined to more recent and higher-fertility soils bordering the Ruamahanga River, such as at Taumata and Greytown. The latter place also produces some small fruits. Of the 77 farms from which data were collected, 43 were dairy farms, 24 were sheep farms concerned mainly with fat lamb raising, and 10 were mixed dairying and fat lamb farms.

The mixed farms were those carrying both beef and dairy stock. Cash cropping played only a small part in the programme of the farms under survey; two of the larger sheep farms grew wheat during the 1953-54 season, three grew peas, and two barley. Small areas of potatoes were grown on several of the dairy farms.

Dairy Farming

Most of the dairy farms were situated on the slow-draining soils of the river flats and the swampy terraces. Fifty-eight per cent. of the farms in the survey were 1-man units with an average size of 108 acres.

TABLE 2—SIZE OF FARMS AND NUMBER OF FARMS IN SIZE GROUPS

Group acres	No. of farms
0 and under 50	2
50 and under 100	21
100 and under 150	11
150 and under 200	6
200 and over	3
	43

The average herd size was 57 cows and 63 per cent. of the farms had herds of under 60 cows.

TABLE 3—SIZE OF HERDS AND NUMBER OF HERDS IN SIZE GROUPS

Group cows	No. of herds
0 and under 20	—
20 and under 40	13
40 and under 60	14
60 and under 80	8
80 and under 100	5
100 and over	3
	43

Dairying is mainly for cheese manufacture. Because of the slow drainage of most of the soils used for dairy farming and the tendency for them to become pugged during winter the usual practice is to remove the stock during this period. During winter it is customary for many dairy farmers to have either a run-off area (generally on stony land) or to purchase grazing. Of the 43 dairy farms in the survey 26 had the herds off the main dairying area during the winter for an average period of 7 weeks.

It is a common practice in the Wairarapa to save surplus fodder as hay rather than silage. Haymaking frequently coincides with the hot, dry spell usual in the Wairarapa during early summer. Not only is there a tendency for hay yields to be reduced and the quality of grass saved to deteriorate, but recovery of a pasture cut for hay is slow under such conditions. Hot, dry spells also limit the amount of autumn growth which can be saved for winter and early spring feeding, as the usual autumn flush is often required in an attempt to restore production which has suffered after a dry summer.

Production and Carrying Capacity

Farm management practices in the Wairarapa are adjusted to a more adverse climate generally than in many other dairying districts in the North Island, and when Wairarapa production is compared with these other areas account has to be taken of much of the dairying area in the Wairarapa being spelled during winter, whereas in many other parts of the North Island production standards are based on an area which generally supports the milking herd and replacement stock throughout the year.

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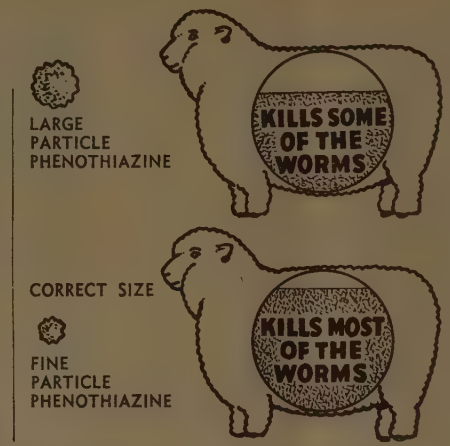

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[*Ministry of Works*

Flood hazards in southern Wairarapa add risks to farming on the rich alluvial land there. Restricted flow of the Ruamahanga River occurs in this region and flood waters can cover extensive areas.

the 1952-53 season was higher than the Dominion average.

TABLE 4—BUTTERFAT PRODUCTION PER COW

Production per cow lb.	No. of herds
150 and under 200	1
200 and under 250	8
250 and under 300	21
300 and under 350	10
No data	3
	43

Butterfat production per acre, however, was low, and as the figures were based on an area generally spelled in the winter, they were really lower than shown by the table.

TABLE 5—BUTTERFAT PRODUCTION PER ACRE

Butterfat per acre lb.	No. of farms
50 and under 100	4
100 and under 150	18
150 and under 200	13
200 and over	5
No data	3
	43

The carrying capacity of the dairy farms has been assessed on the basis of dairy cow equivalents, all stock on the farms being converted to this stock unit.

TABLE 6—CARRYING CAPACITY ON DAIRY FARMS

Dairy cows per 100 acres	No. of farms
25 and under 50	6
50 and under 75	20
75 and under 100	14
100 and under 125	3
	43

Pasture Management

It appears that at present on all but the more fertile soils pastures decline in vigour at 5 to 6 years old. Data collected from the 43 dairy farms show the average age of pastures to be approximately 10 years.

It is the practice generally in the district to grow a fodder crop after ploughing lea before resowing to pasture, and it is the exception to sow a pasture directly out of grass. The most common procedure is to plough in winter and to take a summer fodder crop and to sow down in autumn after the crop has been fed off. Another practice is to plough in spring and to take both an early spring crop and a summer crop before sowing down to pasture again. Practically all farmers sow pasture in autumn. Only rarely is a cover crop sown with new pasture, these crops including oats, turnips, and kale.

Some information was obtained on the predominant grazing systems, which are shown in Table 7.

TABLE 7—GRAZING SYSTEMS ON DAIRY FARMS

System	No. of farms
Rotational plus electric fence	14
Rotational alone	10
Rotational plus free range	7
Rotational plus free range and electric fence	6
Free range grazing only	4
Electric fence and free range	1
Electric fence alone	1
	43

Though 22 farmers used the electric fence, the impression gained was that very few used the method to ration graze their whole farm throughout the season. It was used chiefly to break feed new grass, oats, and any pasture saved from autumn.

Though most of the farmers used some form of rotational grazing, in very dry summers and autumns the tendency was for a free range system of grazing to be adopted, the stock having access to several paddocks to obtain sufficient food. Grazing methods appeared to be governed to a large extent by climate. Twenty farmers, 47 per cent. of the dairy farmers, had separate day and night paddocks. Sixteen farms were recorded as having specially saved pasture during late autumn for early spring. As a number of the herds were wintered off the home farm, late autumn growth was automatically saved. Thirty-two farms conserved surplus grass as hay and only six made silage.

Supplementary Fodder Crops

Though dairy production in the district depends mainly on the utilisation of pasture, some farmers grow both summer and early spring fodder crops as an insurance against dry spells during summer and early autumn, and also to provide supplementary fodder when calving begins and before the spring flush of pasture growth. In the survey 20 farmers grew a summer crop; just under half grew soft turnips, the remainder growing kale, maize, millet, and chou moellier. Nineteen farms grew a winter and early spring crop, and in order of popularity, oats, chou moellier, mangolds, and sugar beet were the main crops grown.

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Fertiliser and Lime Usage

Superphosphate, basic slag, and lime were widely used, only six dairy farmers topdressing less than 10 per cent. of their farm areas with superphosphate or basic slag, and only 16 farmers liming less than 10 per cent. of the farm area.

Water Supply

In general farm water supply presents no great problem. The western side of the plain is supplied with a well-reticulated water race system and small creeks and drains are also important sources. Most difficulty in assuring adequate water occurs on the undulating areas, but dams and bores usually provide the necessary supply. There are many places on the plains where bores are successful.

Shelter

Pinus radiata plantations and macrocarpa hedges were the predominant types of shelter. Data collected and general observation indicate that the standard of shelter in the Wairarapa is rather poor. There was a lack of shelter, especially in the more exposed areas near Featherston. There is considerable scope for the planting of more shelter belts and plantations across the plain.

Buildings, Plant, and Machinery

Of 43 dairy farms, 35 had hay sheds or barns, 16 had tractor or truck sheds, and 26 had implement sheds.

Thirty-one had a tractor, 21 a truck, and 32 cultivating implements. Though 23 farmers had a mower, only three had hay balers, much of the baling being done by contract. Only four farmers owned buckrakes.

Future of Dairying

With an increase in nearby urbanisation, improved transport facilities to the Hutt Valley and Wellington by the new tunnel route, and the drainage of some of the poorly drained but fertile soils there may be a change from seasonal dairying for cheese production to whole milk production for town supply.

Sheep Farming

Of the total area of all the farms covered in the survey, sheep farms accounted for 61 per cent. Sheep farming is the predominant feature on the grey shallow soils of the dry, stony plains and the undulating lands.

. . . FARMING IN WAIRARAPA

Fifty-four per cent. of the sheep farms were 1-man units, the average size being 483 acres.

TABLE 8—SIZE OF SHEEP FARMS AND NUMBER OF FARMS IN SIZE GROUPS

Group (acres)	No. of farms
100 and under 200	5
200 and under 300	7
300 and under 400	4
400 and under 500	1
500 and under 600	1
Over 600	6
	24

Though the average flock size was 1020 ewes, 42 per cent. of the flocks had between 500 and 1000 ewes.

TABLE 9—SIZE OF FLOCKS AND NUMBER OF FLOCKS IN SIZE GROUPS

Group	No. of farms
Under 500	6
500 and under 1,000	10
1,000 and under 1,500	3
1,500 and under 2,000	2
2,000 and under 2,500	2
Over 2,500	1
	24

The sheep farms on the plain are mainly engaged in fat lamb production, and replacement ewes are bought from the surrounding foothills. Of the 24

[*Whites Aviation*

Closely subdivided dairy farms near Carterton.

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This view toward Martinborough from the north-west shows the rich river flats bordering the Ruamahanga River.

farms in the survey eight bred their own replacement ewes and the others generally bought in cast-for-age ewes. The ewes were predominantly Romney breed and the fat lamb sires were chiefly Southdowns.

The system of sheep farm management, minimum stocking during winter and drafting lambs away early in autumn, fits in well with the climate of the Wairarapa and the general practice of minimum reliance on supplementary fodder crops. Only six farms grew summer crops of turnips or rape and 10 grew winter and early spring crops, of which chou moellier and swedes were the most popular. The tendency to draft fat lambs early is indicated from the data for the 1953-54 season, when half of the farms had their last draft away before mid-March. This practice of drafting lambs fat off the mothers or relatively early after a short post-weaning period on grass rather than finishing them on a fattening crop probably results in a lighter lamb. The following table indicates relatively light weights, though these data apply to a dry year, when lamb weights would be lower.

TABLE 10—LAMB WEIGHTS ON SURVEYED FARMS IN 1953-54

Average lamb weight	No. of farms
lb.	
26 and under 30	2
30 and under 33	12
33 and under 35	8
No data	2
	24

Early August is the most popular lambing time, and about 70 per cent. of the total lambing is completed by then. The average lambing percentage for the 1953-54 season was 104, with a range between 84 and 123 per cent.

Carrying Capacity and Production

For the survey all stock on the sheep farms were converted to the common denominator the ewe equivalent to compare the carrying capacities of the farms.

TABLE 11—WINTER CARRYING CAPACITY ON SHEEP FARMS

Ewe equivalents per acre	No. of farms
Under 3.0	4
3.0 and under 4.0	10
4.0 and under 5.0	6
5.0 and under 6.0	2
Over 6.0	2
	24

Most of the farms had a winter carrying capacity of between 3 and 5 ewe equivalents per acre.

The average fleece weight per acre was 23.9lb., with a range of between 12.4lb. and 39.8lb.

Pasture Management

It was found that the average age of pastures on the sheep farms was 10 years. Grazing management followed the general pattern of set stocking from lambing to weaning and rotational grazing for the remainder of the year. Only six farms adopted set stocking for the whole year.

Surplus grass was conserved for hay and 15 of the 24 farmers made hay. Four farmers saved pasture during autumn for early spring feeding.

Fertiliser and Lime

Superphosphate, basic slag, and lime were widely used on the sheep farms, only one farmer topdressing less than 10 per cent. of the farm area with superphosphate or basic slag, and only six farmers liming less than 10 per cent. of their farms.

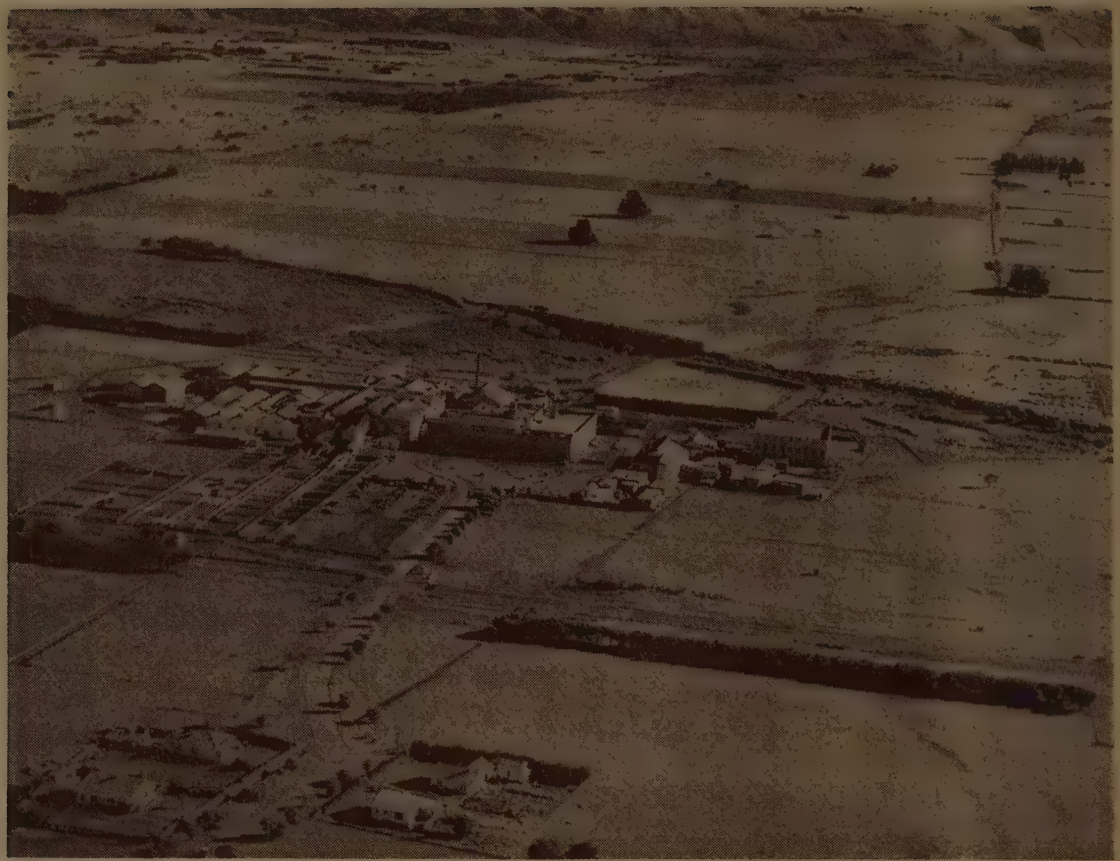
Water Supply and Shelter

Most of the sheep farms had an adequate water supply, but as with the dairy farms there was inadequate shelter from plantations and hedges.

Buildings, Plant, and Machinery

Of the 24 sheep farms, 20 had woolsheds, 10 a tractor shed or truck shed, 13 an implement shed, and 16 a hay shed or barn.

Two-thirds of the farms had tractors, 13 had a truck, and 17 cultivating implements. Most of the topdressing and hay baling was done by contractors, and only six farmers owned a topdresser and two a hay baler.



[*Hope Cross*

Fat stock in the district go mainly to Waingawa freezing works, shown above, though some are transported to Ngauranga or Petone to be killed. The farming land surrounding Waingawa is typical of the dry, stony plains soils.

Cattle

Three-quarters of the sheep farmers in the sample had beef cattle. Twelve of them ran breeding cows, the remainder buying in cattle to fatten or sell as stores.

Mixed Farms

In general both sheep and dairy cows are run on mixed farms because it suits the state of development of the farm or variation in soil types on the farm. Seven of the 10 farmers in this category had portions of their property either in a partly developed state or part of the farm with a lighter soil than the main dairying area. Generally these maintained a ewe flock on the lighter areas and sold fat lambs. These lighter areas served additionally as run-off areas for dairy stock in winter.

The remaining three farmers wintered off their dairy herds. They bought store sheep in autumn, kept them over winter, and sold them in spring before the dairy cows began milking. The net return from the sheep helped to pay for the cost of winter grazing of the cows and less damage was caused to the wet pastures than if the dairy stock had been left on them.

Six of the 10 mixed farms had areas of between 100 and 400 acres, and with the total stock converted to ewe equivalents the carrying capacity of most of the farms ranged from 2 to 6 ewe equivalents per acre.

Future of the Area

Study of the pastures and problems of the 77 farms in the survey indicates that the production from the area can be increased considerably. One factor which can do much to increase the productivity of farms, particularly in the southern part of the district, is better drainage, but even with this co-ordinated schemes for some parts may be necessary.

The adoption of management techniques which have proved successful in other intensive farming areas of the North Island may not prove so successful in the Wairarapa. Here dry spells in summer, often severe enough to be classed as droughts, are commonplace, and management techniques will have to be adjusted to meet the climatic conditions. However, new management techniques are being tried out and no doubt they will eventually be modified and moulded to the Wairarapa Plain environment.

Acknowledgment

Help and material provided by officers of the Soil Bureau of the Department of Scientific and Industrial Research, the Meteorological Office, Air Department, the Railways Department, the Geography Department of Victoria University College, and Mr. H. G. Bagnall, National Library Service, are acknowledged.

Certification of Legume Seed Inoculants

By A. HASTINGS,
Plant Diseases Division, Department of Scientific and Industrial Research, Auckland

IN recent years experiments carried out on a number of soil types in various parts of New Zealand by the Plant Diseases Division and Grasslands Division of the Department of Scientific and Industrial Research and by the Extension Division of the Department of Agriculture have shown that considerable benefit occurs from the inoculation of clovers with root nodule bacteria. Where clover growth without inoculation has not been satisfactory inoculation has in many cases improved establishment and brought about spectacular increases. Success of the experiments has created considerable interest in the use of legume seed inoculants and as a result various New Zealand and overseas firms are offering legume cultures for sale.

AS investigations by the Plant Diseases Division have been confined to undeveloped country and land not previously in pasture, the Division has no experimental data on the effect of inoculation on clovers sown in high fertility or established pasture land. Results of trials on newly developed country are being prepared for publication by Dr. W. D. Reid, formerly of the Plant Diseases Division.

Variable Results

Glasshouse and field trials have shown that numerous strains of clover root nodule organisms are present in New Zealand and that these vary greatly in their ability to promote clover growth. A number of strains tested during the investigations were ineffective and when used in field trials failed to produce better growth than that obtained with uninoculated seed. It has also been shown that strains vary in relative efficiency on different clover species. Thus some strains are highly effective on subterranean clover, but give poor response on red and white clover, and others give good results on red or white, but are poor on subterranean clover. Of the large number of strains tested only two were found to be highly satisfactory on all three clovers.

A culture when applied to the seed should contain sufficient numbers of organisms capable of forming nodules. The nodules must have the ability to supply adequate nitrogen to the plant, thereby bringing about better establishment and increased clover growth. The culture should not contain organisms deleterious to nodule bacteria or host plant.

Certification

To ensure that the farmer can select commercial cultures of proven efficiency a voluntary scheme for the certification of legume cultures has been inaugurated by the Plant Diseases Division. It is intended that the scheme will at first be limited to cultures for red, white, and subterranean clover and for lucerne.

To determine the value of a culture the certification tests will be as follows and the methods used will agree closely with those recommended in Australia by Vincent (1954).

1. Laboratory counts: To determine numbers of living root nodule bacteria and organisms other than root nodule bacteria present.

HEADING PHOTOGRAPH: Spectacular increase in clover growth as a result of inoculation in a large-scale field trial. Left—No inoculation. Right—Inoculated. Department of Scientific and Industrial Research photo.

2. Glasshouse tests using agar-tube methods and pot trials with selected soil: (a) To determine numbers of bacteria capable of forming nodules. (b) To determine their efficiency in relation to the host plant.

3. Field trials: To test the value of cultures when in competition with other strains of root nodule bacteria and with other organisms in the soil. In all tests comparisons will be made with proven strains.

Seed inoculation has been shown to be an efficient and low-cost aid in clover establishment in many parts of New Zealand. However, care must be taken in the handling and use of living bacterial cultures. The manufacturers' instructions regarding use and storage of the cultures should be followed implicitly.

Precautions during Use

Precautions to be followed when inoculated clover seed is being sown are similar to those observed for the sowing of inoculated lucerne, namely:—

1. Do not expose inoculated seed to direct sunlight.

2. Do not mix inoculated seed with: (a) Superphosphate, basic superphosphate, serpentine superphosphate, or compounded superphosphate. (b) Nitrate of soda or sulphate of ammonia. (c) Potash. (d) Blood and bone. (e) Any other manure containing nitrogen or potash.

(Inoculated seed may be sown with superphosphate, basic superphosphate, serpentine superphosphate, or compounded superphosphate if an equal quantity of lime is added. Inoculated seed may be sown with basic slag without the addition of the lime.)

3. Do not store inoculated seed for longer than 48 hours after inoculation.

The better the methods used for seeding are the better will be the response to inoculation. Trials have shown that drilling of inoculated seed is better than broadcasting. The use of fertilisers and trace elements known to be beneficial for clovers is also beneficial for the added nodule bacteria.

Inoculation is one of many practices the farmer should carry out to ensure successful clover establishment on poor country. Any doubts concerning the use of a culture should be referred to the local Instructor in Agriculture.

Manufacturers seeking certification of their cultures can obtain details of the scheme and application forms from the Director, Plant Diseases Division, Private Bag, Auckland.

Reference

Vincent, J. M., "The Control of the Quality of Legume Seed Inoculants", "Journal of the Australian Institute of Agricultural Science", vol. 20, pp. 247-249 (1954).

Legume Inoculants Certified as at March 1956

Trade name of product	Manufacturer and/or agent	Carrier	Certified for inoculation of:—
	CLOVER		
Agserv Inoculum B	Ivon Watkins Ltd., P.O. Box 124, New Plymouth, N.Z.	Peat	Red and white clover
Biolab C	Biological Laboratories, P.O. Box 2749, Auckland, N.Z.	Agar	Red, white, and subterranean clover
Inoculaid C	Dalgety and Co. Ltd., P.O. Box 1397, Wellington, N.Z., and branches	Agar	Red, white, and subterranean clover
Inoculator C	The Farmers' Co-op. Wholesale Fedn. of N.Z. Ltd., P.O. Box 1124, Wellington, N.Z., and the Farmers' Co-op. organisations throughout N.Z.	Agar	Red, white, and subterranean clover
Inoculo 3	Inoculo Laboratories, 72 Victoria Crescent, Mont Albert, Melbourne, Australia.	Peat	Red and white clover
Legulon C	Wright, Stephenson & Co. Ltd., P.O. Box 1895, Wellington, N.Z., and branches	Agar	Red, white, and Subterranean clover
Nitrogon C	Pyne, Gould, Guinness Ltd., P.O. Box 112, Christchurch, N.Z., and branches	Agar	Red, white, and subterranean clover
Nodulaid B	Agricultural Laboratories, Pty. Ltd. Sefton, Australia. N.Z. Loan and Mercantile Ag. Co. Ltd., P.O. Box 1498, Wellington, N.Z., and branches	Peat	Red and white clover
Nodulaid C	Agricultural Laboratories Pty. Ltd., Sefton, Australia. N.Z. Loan and Mercantile Ag. Co. Ltd., P.O. Box 1498, Wellington, N.Z., and branches	Peat	Subterranean clover
Nod-o-Gen 2	The Albert Dickinson Co., Chicago, U.S.A. Seed Inoculants (Nod-o-Gen) Ltd., P.O. Box 7, Ashburton, N.Z.	Humus	Red, white, and subterranean clover
Nod-o-Gen 2 in 1	The Albert Dickinson Co., Chicago, U.S.A. Seed Inoculants (Nod-o-Gen) Ltd., P.O. Box 7, Ashburton, N.Z.	Humus	Lucerne and subterranean clover
	LUCERNE		
Biolab L	Biological Laboratories Ltd., P.O. Box 2749, Auckland, N.Z.	Agar	Lucerne
Inoculaid L	Dalgety and Co. Ltd., P.O. Box 1397, Wellington, N.Z., and branches	Agar	Lucerne
Inoculator L	The Farmers' Co-op. Wholesale Federation of N.Z. Ltd., P.O. Box 1124, Wellington, N.Z., and the Farmers' Co-op. organisations throughout N.Z.	Agar	Lucerne
Inoculo 1	Inoculo Laboratories, 72 Victoria Crescent, Mont Albert, Melbourne, Australia	Peat	Lucerne
Legulon L	Wright, Stephenson & Co. Ltd., P.O. Box 1895, Wellington, N.Z., and branches	Agar	Lucerne
Nitrogon L	Pyne, Gould, Guinness Ltd., P.O. Box 112, Christchurch, N.Z., and branches	Agar	Lucerne
Nodulaid A	Agricultural Laboratories Pty. Ltd., Carlingford Rd., Sefton, Australia. N.Z. Loan and Mercantile Ag. Co. Ltd., P.O. Box 1498, Wellington, N.Z.	Peat	Lucerne
Nod-o-Gen 1	The Albert Dickinson Co., Chicago, U.S.A. Seed Inoculant (Nod-o-Gen) Ltd., P.O. Box 7, Ashburton, N.Z.	Humus	Lucerne
Nod-o-Gen 2 in 1	The Albert Dickinson Co., Chicago, U.S.A. Seed Inoculant (Nod-o-Gen) Ltd., P.O. Box 7, Ashburton, N.Z.	Humus	Lucerne and subterranean clover

Care of Milking Machine Rubberware

By W. G. WHITTLESTONE,
Physical Chemist, Department of Agriculture's Ruakura Animal Research Station

SOME of the commonest faults in the milking machine arise from the failure of rubber parts. The aim of this article is to help the farmer to understand the nature of rubber so that in its use and care he can avoid treatment which will shorten its life or reduce its efficiency. With the introduction of synthetic rubbers it is even more important for the user to understand the properties of the material he handles. Under good conditions a synthetic material may outlast the natural product by a large margin; improperly used, however, it may appear to be inferior to natural rubber. This article outlines the nature of rubber and the problems involved in compounding it to suit the often difficult conditions in the cow shed.

RUBBERY compounds occur fairly widely in nature. However, the source of most natural rubber is a tree, *Hevea braziliensis*, which occurs wild in Brazil and which is normally grown in plantations for the commercial production of rubber. The rubber tree produces a sap which is rather like milk in that it contains globules of the rubber substance (known chemically as a hydrocarbon) dispersed in a watery solution of protein and salts. Instead of centrifuging the globules out as is done with the butterfat in milk the rubber is made to coagulate by the addition of acid, a process somewhat similar to the manufacture of lactic casein.

Sometimes the coagulated rubber is formed into rough sheets by rollers and is then smoked to dry and preserve it. This is known commercially as "smoked sheet" rubber. Another method involves the thorough milling and washing of the coagulated rubber crumbs, which are worked into sheets. These are dried in the dark and are known as "pale crepe" rubber.

Little can be done with raw rubber, as it decomposes readily in the presence of heat or light. To make it tough and durable sulphur is added by a milling process and the mix is "vulcanised" or "cured" at a high temperature. The sulphur reacts chemically with the rubber hydrocarbon and and ties the long molecules together, so producing greater toughness and heat resistance.

Simple vulcanised rubber is, however, of little value commercially because of its poor resistance to air, sunlight, and abrasion. Fillers are added to harden the rubber and increase its resistance to wear. Many of the properties of the final rubber such as colour, hardness, water resistance, and wear resistance are determined by the filler used. Fillers are of two kinds; those which merely dilute the mixture and give desirable properties such as colour and stiffness but do not contribute to the tensile strength or tear and abrasion resistance, and those which improve the tensile strength and tear and abrasion resistance. The second group are called reinforcing fillers, and include zinc oxide, magnesium carbonate, and carbon black.

To speed up the vulcanising process accelerators are needed. These reduce the damage done by heat to the rubber hydrocarbon during vulcanising or curing and also increase the amount of rubber which can be processed in a given time, so reducing cost. Because rubber is unstable in the presence of oxygen, particularly in bright light, age retarders or anti-oxidants are added. Pigments and colours are also added when required, and softening agents are used in some applications.

As can be seen, vulcanised rubber is a complex mixture. To make the processing more difficult there are considerable variations in the raw material, so that the skill of the compounder is required to maintain a uniform material. Great variations in the final product can be effected during the milling process, when the ingredients are worked together, or during curing, when the sulphur reacts with the raw rubber. Modern chemicals have greatly improved the uniformity of the manufacturing process and its final outcome, but much still depends on the skill of the operators.

As an illustration of the complexity of a rubber mix, the following are the approximate proportions by weight of the constituents of a tyre tread stock:—

Smoked sheet	100
Pine tar	3
Stearic acid	4
Anti-oxidant	1
Zinc oxide	5
Carbon black	50
Sulphur	3
Accelerator	1

Synthetic Rubbers

Many attempts have been made to synthesise an artificial rubber with better properties than the natural product. So far no synthetic material has appeared which has the good all-round properties of natural rubber. However, for special applications where special qualities are needed synthetics offer marked advantages. Fat and oil resistance is an example. Natural rubber takes up oils and fats readily, becoming soft and weak as a result, but some synthetic rubbers have excellent resistance to fats and oils. Resistance to light is another advantage which some synthetic rubbers have over natural rubber.

A hard moulded inflation teat cup. This type of teat cup has a heavy ribbed moulded inflation which is normally under slight tension.

By combining natural and synthetic rubbers it is possible to make a range of products with qualities suited to the particular application. This point will be illustrated in the discussion on rubber milking machine components.

Rubber on the Milking Machine

The different rubber parts of the milking machine have very different functions and for this reason should be made of different types of rubber. It

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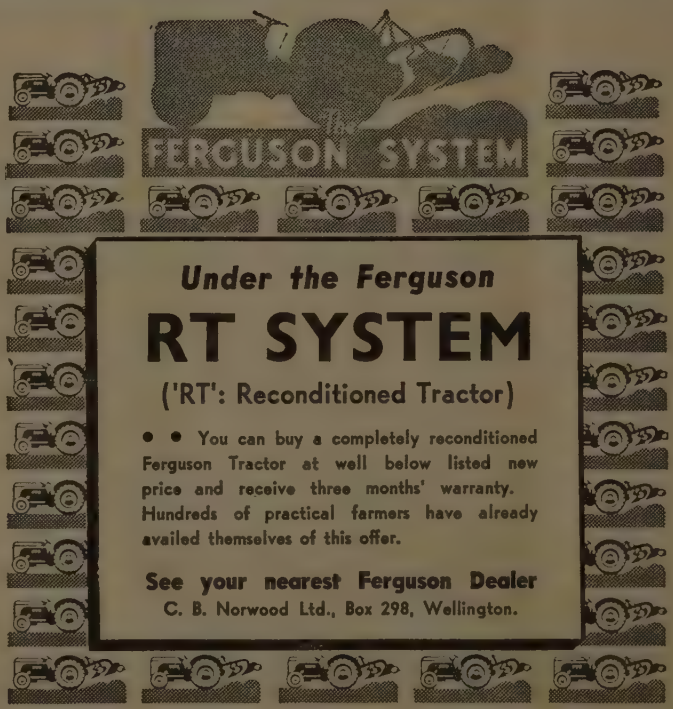

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is useful to study these different parts to determine the right rubber for the job and the correct treatment to ensure long life.

The two worst enemies of rubber on the milking machine are butterfat and light. Together they have a drastic effect on rubber, as in addition to the decomposition of rubber caused by light the butterfat has the property of taking up oxygen from the air and handing it on to the rubber with resultant breakdown and cracking. Some rubber parts of the machine are subjected to butterfat without light, some to light without butterfat, and others suffer from the effects of both.

Rubber Joints

Pipe joint rings, releaser rings, releaser flaps, and such parts do not have to stretch and may be quite hard; pipe rings and flaps also come in intimate contact with milk. The ideal rubber for such parts, therefore, is fat resistant, maintains a shiny, smooth surface, and for releaser rings does not perish where it is exposed to light. The best material is "nitrile" rubber, based on two synthetic substances called butadiene and acrylonitrile. This type of rubber gives an excellent performance in flaps and rings. It has a tendency to "stay put" when stretched, a quality known technically as high permanent set. It should therefore never be stretched unnecessarily and rings should not be stored in a kinked condition but should be kept in their natural shape.

A "universal" type teat cup. The inflation in this cup is a tube of rubber which is kept under tension in order to seal the mouthpiece against the cup case. Without this tension such a cup is unstable and will not milk properly.

Milk, Air, and Claw Tubes

The large milk and air tubes are not subjected to undue stress and may be made of a normal natural rubber mix of suitable hardness. However, it is usually not economical to use a rubber for these tubes which is different from that used for claw tubes, which are subjected to very difficult conditions. They are kinked and knocked through cups falling, are handled with greasy hands (when some teat salves are used), and are often left between milkings in a kinked or otherwise stressed condition.

When rubber is knocked between two hard surfaces it bruises, and if the surfaces are sharp or rough, cuts develop. Water accelerates this effect, but the use of a carbon black filler reduces the tendency to cut when knocked. No synthetic rubber has the strength of natural rubber or its ability to resist knocking or kinking. The best rubber for claw tubes (and also for milk and air tubes) is therefore a carbon black reinforced natural rubber designed for high tensile strength and reasonable flexibility. A rubber not unlike a tyre tread stock with a "soft" carbon black filler will give an excellent performance. Field trials have shown that clay-filled rubber will break down in under 6 months, but carbon black rubber under the same conditions will last for 2 years.

The care of rubber tubing involves the following rules:—

1. Do not use hard brushes on tubes. There is no reason for using any brush on the inside of milk tubes if the proper cleaning methods are used. Brushing tends to score and roughen the smooth internal finish and makes the rubber more difficult to clean. When brushing the outside of the claw assembly use a soft brush which will not roughen the rubber surfaces.
2. Clean the milking machine with the recommended detergent twice a day. Once a fortnight soak the whole cup claw assembly including the milk and air tubes in double strength Ruakura type alkaline detergent between milkings. This will soften any external dirt and will help to prevent unnecessary perishing of the rubber.

A soft moulded inflation teat cup. The inflation and claw tube in this type of teat cup are moulded in one piece.

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163

3. Never soak rubber parts in chlorine solutions, and if a chlorine solution is run through the machine, make sure that all rubber tubes are drained free of solution immediately.
4. Do not use greasy teat salves. Such preparations contaminate the inflations, causing softening and deterioration. They tend to spread over the claw tubes from the operator's hands and cause much damage to the rubber. There are excellent antiseptic teat salves on the market which contain no grease and are superior as antiseptics to the greasy type.
5. Between milkings the cup clusters should be hung in the shade, as direct sunlight has a very destructive effect on rubber. Carbon black rubber has a better light resistance than light-coloured stock because of the screening effect of the carbon. However, even this will last longer if kept out of direct sunlight.
6. Between milkings hang claws up so that the tubing is not kinked or under stress. A simple wooden rack which allows the cups to hang downward and keeps the claw tubes straight or only slightly curved gives the right conditions for avoiding stress.
7. Make sure that all claw nipples are free from sharp edges. Claw tubes commonly fail because of the development of holes near the nipples. These holes often appear suddenly and the rubber is blamed, but what happens in most cases is that because the cups are folded back as they are being put on or because they fall on to the concrete floor, small cuts start **on the inside** where a sharp nipple comes against the rubber. The cut emerges on the outside at a time which the farmer cannot associate with an accident such as a fall, and he therefore blames the rubber. When a small hole suddenly appears in a claw tube the cup and claw nipples should be checked for sharp or rough edges. Carbon black rubber is greatly superior to ordinary tubing stock and will resist cutting much more effectively. However, it is unwise to use rough metal nipples in any rubber tube, regardless of the quality.

Inflations

The inflation is the most problematic rubber part of the milking machine. Generally inflations may be divided into three types; hard moulded, soft, and soft moulded.

Hard Moulded Inflations

Hard moulded inflations consist of heavy rubber mouldings usually ribbed and intended to collapse from the tops down. They originated in the days when it was erroneously thought that the milking machine extracted milk by a squeezing action. The rubber is not under stress and the hard inflation therefore tends to have a long life. Their somewhat brutal action makes them unsuited for young cows or cows with sensitive teats, and many troubles have been traced to the uncomfortable effect of this type of inflation. When they are made from natural rubber they develop fine surface cracks, and unless they are sterilised by being boiled from time to time they may become carriers of infection.

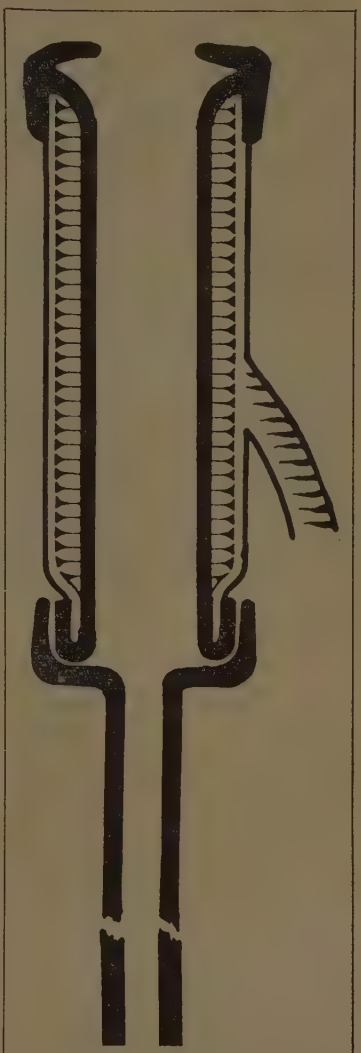
Generally hard inflations offer no advantages over other types and are not regarded as suitable for modern non-stripping milking conditions, which require the maximum co-operation from the cow. The restlessness of many herds milked with hard inflations bears mute testimony to the cows' feelings about this particular type of inflation.

Soft Inflations

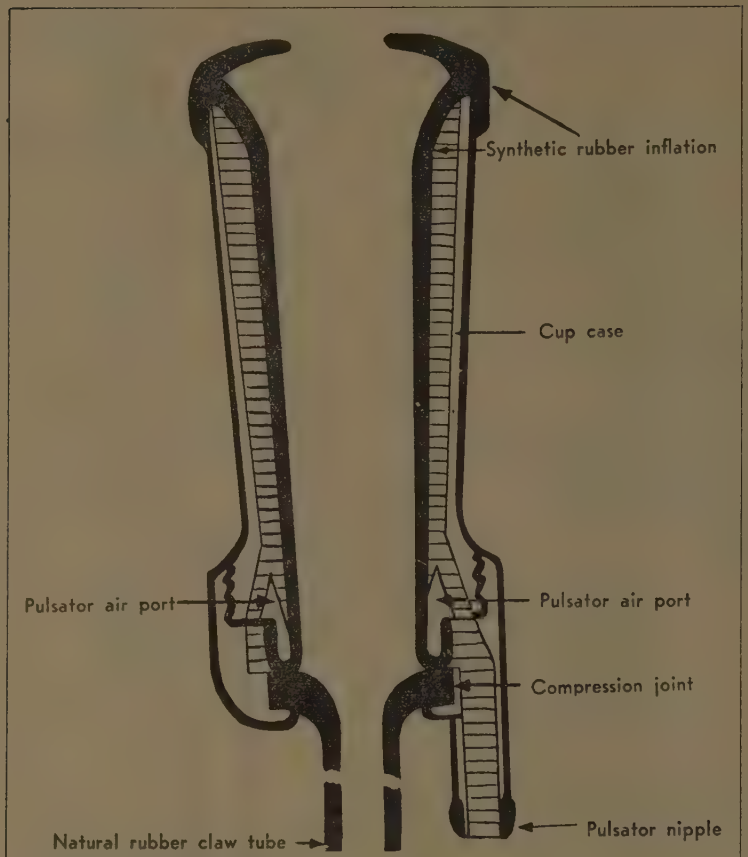
Soft inflations have been the most popular type in New Zealand for many years. They are comfortable for the cow and supply excellent conditions for fast milking. They have two disadvantages. First, they require regular adjustment. If the mouthpiece is allowed to become slack, it tends to become misshapen, because the whole assembly is held firmly in place by the tension on the rubber. Because of this tension soft inflations also perish more rapidly than do untensioned inflations. This means that in addition to being tightened regularly soft inflations should be changed every 6 weeks. Secondly, because of the need for a mouthpiece ring and a nipple or plug connection to the claw tube soft inflations present more crevices where dirt may lodge. They are therefore more difficult to clean than the types not using rings and nipples.

A common source of failure in a soft inflation is the development of cracks and holes around the mouthpiece. This may be due to the use of sharp or rough mouthpiece rings which cut the rubber from the inside. In certain badly designed teat cups the rubber mouthpiece protrudes beyond the metal cup case. If the claw assembly falls on the floor, there is a chance that the mouthpiece will hit the concrete, often starting a small cut **on the inside.** Because of the tension in the mouthpiece such a cut spreads and soon appears as a hole. Mouthpiece rings must be smooth and the rubber must be protected from being knocked by the rim of the cup case.

The problem of designing a rubber for soft inflations is not simple. Because of their inherently unhygienic nature they should be changed or at least completely disassembled and boiled in detergent solution every 6 weeks. The use of an expensive synthetic rubber is hardly justified in the case of a short-life article. It seems likely that a satisfactory surface treatment of natural rubber and/or the use of small amounts of synthetic in the mix are the best approaches to the making of a good soft inflation. Surface treatment will reduce fat absorption by a factor of ten, thus almost eliminating one of the main causes of poor performance in the field.



A soft moulded inflation teat cup. In this cup the moulded inflation is under slight tension and is separate from the claw tube. The latter is integral with a cap which fits over the lower end of the inflation where it folds over the cup case.



A soft moulded inflation teat cup. In this experimental teat cup a separate inflation and claw tube are used, the two parts being held together by a compression joint.

Soft Moulded Inflations

Soft moulded inflations offer the best combination of milking efficiency and hygiene. This type of inflation has a top moulded so that it is integral with the wall and in some cases the claw tube is also integral with the inflation wall. When properly designed the moulded mouthpiece of the inflation fits snugly over the cup casing without stress. This greatly enhances the life of the rubber. If the claw tube is part of the inflation, the result is the most hygienic type of teat cup possible.

This type of structure, however, presents difficulties. The ideal material for the inflation is synthetic rubber, but the claw should be made of natural rubber. One solution is the use of a metal nipple on a plate which is held firmly against the inflation where it folds over the base of the cup case. The claw tube is fitted to the metal nipple. This system reintroduces some of the unhygienic crevices which it is the aim of good design to exclude.

Another system uses a single rubber moulding with a synthetic top and a natural tail, a solid block being provided for the two kinds of rubber to mix within to ensure a strong bond. This system is good but very expensive.

A third system has a natural rubber claw integral with a cup which clips over the bottom of the synthetic inflation where it folds back over the cup case. Experiments with this system at Ruakura have shown that it is not satisfactory hygienically unless the claw tubes are removed and washed separately after each milking.

A solution under investigation at Ruakura at present uses a claw tube with a solid cylindrical end. This end is held under compression against the bottom of the synthetic inflation. The compression joint between the two rubbers forms a hygienic seal. How it will stand up after prolonged use is not yet known. The teat cup designed to fit this type of inflation and claw tube is provided with special pulsation ports at the bottom of the cup case so that water cannot accumulate between the inflation and the wall of the cup. This cup eliminates the stress-producing tension which is often applied to soft moulded inflations and so produces conditions conducive to a long, hygienic life. It is a common fallacy that the inflation must be under tension. This is true only for the soft inflation, because in this case the tension holds the cup together and prevents the mouthpiece from leaking or slipping.

Because the inflations have the worst conditions of all the rubber parts of the machine, they require extra care. The rules for long, hygienic life are:—

1. Clean the machine tubes daily with a good detergent.
2. Never use brushes on the inside of the cups and use them very sparingly on the outside.
3. Never use greasy teat salves.
4. When flush cleaning is practised soak the teat cups at least once a fortnight in double strength alkaline detergent. If circulation cleaning is used, hose the outside of the cups during circulation and rub off any dirt with a suitable cloth.
5. Do not hang the claws in direct sunlight.

If the farmer follows the simple rules set out in this article, he will greatly improve the performance of his milking machine rubberware. It is the aim of modern rubber technology to give the farmer inflations and claw tubes which will last a year. Once a year all inflations and claw tubes **must** be changed. Milk and air tubes will last 2 seasons and should be changed regularly after 2 years' service. Releaser flaps and the like should be checked annually by a serviceman and should be changed when inspection shows any tendency to seat incorrectly.

The farmer should remember that the three great enemies of rubber in the cow shed are **stress**, **butterfat**, and **bright light**. If kinking and bending of tubes during storage between milkings, the commonest causes of stress, and the use of sharp metal fittings are avoided, if thorough cleaning is practised regularly, and if exposure to direct sunlight is avoided, milker rubberware will respond with a better life and more efficient service on the machine.

Acknowledgment

The writer wishes to express his gratitude to Mr. G. C. W. Reid of Reid (N.Z.) Rubber Mills Limited and to members of his staff for assistance during the investigations into milking machine rubberware which have recently been conducted at Ruakura.

Sources and Qualities of New Zealand Honey

Seasonal Notes for the Domestic Beekeeper

HONEY is wholly derived by honey bees from the nectar of plants, and its colour, flavour, and consistency may vary widely according to the plant source from which it is gathered. Honeys produced under identical weather conditions but from different species of plants may vary in colour from water white to dark brown and have flavours ranging from extreme delicacy to most pronounced. In this article D. Roberts, Apiary Instructor, Department of Agriculture, Auckland, discusses the sources and characteristics of some of the more common New Zealand honeys.

HONEY bees gather nectar from innumerable species of plants, but the great bulk of New Zealand honey is derived from only a relatively small number which are abundant over large areas.

Though the flowers of some plants produce nectar in easily observable quantities, the output per individual blossom of most honey producing plants is very minute indeed, and considerable areas of such blossom must be present before even one colony can gather a surplus of honey from it. Several acres of good pasture sources are needed to meet the demands of each colony of bees, though some tree sources will provide a surplus from smaller areas. Because of this it has not yet been possible to discover a plant which can be economically grown for honey production alone. Much research has been devoted to this end overseas, but even the most prolific of nectar producing plants have been found to fall far short of the requirements needed to make their planting for this purpose economic.

The production of good honey crops is possible only where there are good sources of nectar producing plants within a mile and a half of the apiary. It is not necessary, of course, that they be of the one species, but heavier crops are generally obtained when there are large areas of these nectar producing plants blossoming simultaneously. This condition occurs for instance where the clovers are predominant in the pastures or where there are large stands of manuka (*Leptospermum scoparium*), rata (*Metrosideros* spp.), kamahi (*Weinmannia racemosa*), pohutukawa (*Metrosideros tomentosa*), rewa rewa (*Knightia excelsa*), or similar valuable sources.

HEADING PHOTOGRAPH: White clover is one of the most important of all honey sources in New Zealand and overseas. To many people its honey presents a standard by which all other honeys are judged.

Where there are sufficient plants of one species available the bees will be able to produce a honey gathered entirely from that particular plant. Honeys produced in such circumstances show very definite characteristics of colour, flavour, and body and experienced beekeepers can easily determine by examination and tasting the source from which the honey was gathered. Large yields of this nature are commonly experienced by commercial beekeepers with apiaries outside built-up areas, but beekeepers with only a few hives, particularly those in urban areas, are not likely to obtain these straight lines, as they are sometimes called. Their honey will mostly be a mixture gathered from many sources, though flavour and colour may be dominated by the honey produced from one particular plant.

Examples of the dominance of a particular flavour are frequent where manuka is present in quantity. Honeys gathered before or even after that from manuka and combined with it by the bees will have the flavour and dense body characteristic of manuka. Even though present in only a small proportion, strongly flavoured honeys

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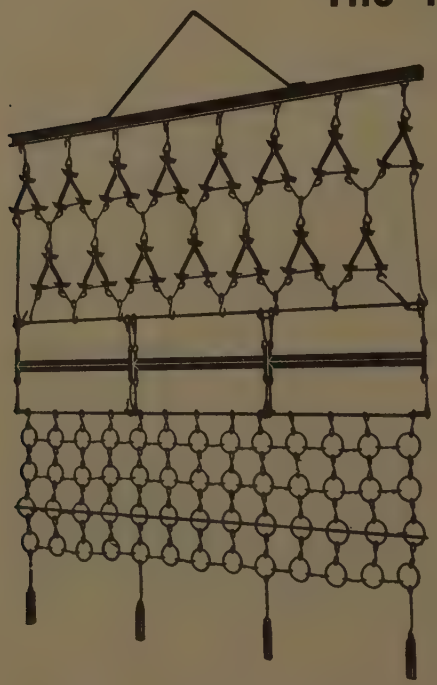

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and those with individual body peculiarities will be found to have a marked influence on those with which they are combined. Consequently, beekeepers desiring to preserve a particular type of flavour will need to order their hive management so that combs containing other honeys are removed from the hive when the flow from the desired source begins. For example, a beekeeper in the Auckland district wishing to obtain a line of pure pohutukawa honey would remove all other uncapped honey from his colonies on the beginning of the pohutukawa flow. Immediately the flow has ceased the combs of pohutukawa are taken from the hive and replaced with those taken previously. In this way it is possible to obtain practically pure samples of various honeys.

The ability to secure these various honeys with their peculiar qualities of aroma, flavour, colour, and body unaffected by the addition of honey from other sources helps to make beekeeping one of the most fascinating of pursuits. Though most beekeepers can practise management designed to secure samples of selected honeys, particular crops of any considerable quantity cannot be expected unless there is present within bee range a sufficient area of the necessary plant variety.

Some common New Zealand sources of distinctive honeys are described in the following notes.

Tree Sources

Manuka or red tea tree (*Leptospermum scoparium*) is one of the most common New Zealand shrubs and is found in most areas of the three islands from the lowlands of the north to above the timber line in mountain areas. It occasionally reaches a tree form with a height of 15ft. to 25ft. but is most usually a shrub, either tall or prostrate depending on locality. The flowers are generally white with a tendency to pink in some northern areas. The flowering period varies with locality, in warmer areas persisting from early autumn to early summer. It is now being eliminated in many areas by a coccid insect (*Eriococcus scoparium*) which favours it as a host.

It yields nectar prolifically and where it is present in any quantity honey bees will desert all other sources of nectar while it is in bloom. The honey derived from manuka is a light amber and has a marked flavour. In addition to the distinctive flavour, manuka honey is notable for its thixotropicity, a trait which is peculiar to only a few honeys throughout the world, the other most well-known example being the ling or heather honey of the British Isles. Thixotropic honeys, as they are called, present many problems in their extraction, straining, and packing and unless the beekeeper is prepared to provide specially developed equipment, satisfactory processing of these honeys will be found extremely difficult.

Because such honeys are very dense and do not granulate rapidly, they are very suitable for comb honey production. Manuka comb honey given reasonable care will remain in first-class condition for a much greater time than most other honeys. When this honey is extracted there appears to be some intensification of the flavour and a considerable loss of aroma which is not apparent when it is consumed in the comb. It is generally preferred in the form of comb honey.

Southern rata (*Metrosideros lucida*) is a medium-sized forest tree growing to 60ft. in height with a trunk from 2ft. to 4ft. in diameter. The leaves are a glossy green, smooth, sharp pointed, and narrow for their length of 1in. to 4in. The flower is bright crimson, appearing in short, broad heads at the ends of shoots. The stamens are numerous as in all species of the genus. It occurs from the Waikato district southward, but is not common in the North Island or on the east coast of the South Island. It favours mountain and sub-alpine areas and is abundant on the west coast and southern part of the South Island and Stewart Island. It flowers from late November onward throughout the summer, bloom occurring later at higher altitudes than at lower altitudes.

Northern rata (*Metrosideros robusta*) is a massive forest tree reaching 100ft. in height. Because the tree usually begins life as an epiphyte, the trunk is irregular in shape and frequently of great size with wide, spreading branches. Leaves are similar in many respects to those of the southern rata, but are more inclined to be elliptical or oval with a leathery surface. The dark scarlet flower is larger and more dense than that of the southern rata. The two species are most easily distinguished by study of the fruit capsule. The fruit of the southern rata is much larger and more woody than that of its northern relative. Northern rata is found in forests throughout the North Island and in the north of the South Island to Greymouth.

Both species, when present in quantity, produce a white, mild flavoured honey with a light body. It granulates readily and when pure usually sets with a fine, silky grain. It is excellent for blending with other honeys and as a starter for granulation. Because of this tendency to rapid granulation it is not suitable for comb honey unless it is to be consumed immediately.

Kamahi or birch (*Weinmannia racemosa*) is a tall forest tree reaching 80ft. in height with an irregular

▲ The honey derived from manuka is a light amber and has a marked flavour. With reasonable care the honey will remain in first-class condition much longer than most other honeys.

▼ Rata when present in quantity produces a white, mild flavoured honey with a light body which is excellent for blending with other honeys and as a starter for granulation.

[*Douglas Elliott*

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trunk 2ft. to 4ft. in diameter. Leaves grow opposite one another, are short stemmed, 1in. to 4in. long, of a broad oval shape with rounded ends, dull green, smooth with a leathery appearance, and with the edges fairly deeply serrated. Flower racemes spring from leaf points or shoot terminals and are 1in. to 4in. long. The stems of the racemes are hairy and bear numerous small, 4- to 5-petalled blossoms.

The tree is abundant in most forests from Kawhia and Tokomaru Bay southward and is found in all forests up to sub-alpine levels. Kamahi bears an abundance of small white blooms through November and December. Kamahi honey is light amber and has a most marked flavour with a bitter edge to it. When the honey is blended with other honeys the flavour inclines to persist and be dominant over all others. When the honey is allowed to granulate naturally the grain will tend to be coarse and uneven.

Pohutukawa or Christmas tree (*Metrosideros tomentosa*) is a massive tree reaching 30ft. to 70ft. in height with a spreading habit of growth. It is common in coastal areas of the North Island south to the Bay of Plenty and has been adapted for ornamental purposes. Leaves grow opposite one another, are short stemmed, rather broad, 1in. to 4in. long, with smooth edges and a white woolly appearance underneath. The upper surface is smooth and leathery. Flowers appear at the ends of shoots, are about 3in. in diameter, and range from light to dark crimson. The flower stalks have the same woolly appearance as the undersides of the leaves.

Pohutukawa blooms from early December to the middle of January and when weather conditions are suitable produces nectar in large quantities. The honey is water white with a heavy, sweet flavour and marked aroma. It granulates readily, crystals sometimes forming within a week or two of its being stored in the combs. For this reason it is not suitable for comb honey production. Pohutukawa does not, however, yield consistently from season to season and is particularly susceptible to cold winds or wet and humid conditions.

Rewa rewa or native honeysuckle (*Knightia excelsa*) is a tall forest tree reaching a height of 90ft. or more with an upright habit of growth. The trunk is comparatively slender, being from 2ft. to 3ft. in diameter. It is found in lowland forests throughout the North Island and in the neighbourhood of the Marlborough Sounds. The leaves are generally narrow, 4in. to 6in. long, with the edges toothed with the teeth pointing outward. The surfaces of fully developed leaves are smooth and hard and the surfaces of young leaves and branchlets have a reddish-brown, velvety appearance. The flowers are borne in lateral racemes 2in. to 4in. long with the reddish flowers closely crowded.

Rewa rewa flowers in November and December and at times produces a very heavy flow of nectar. Like pohutukawa it is not a consistent yielder, though there is not usually a complete failure as often occurs with pohutukawa. The honey is a dark amber with a rich, distinctive flavour and is easily extracted from the combs.

Other Tree Sources

Apart from the trees described there are several others such as the willows (*Salix* spp.) and kowhai (*Sophora microphylla*) which are important spring nectar sources. Other indigenous trees and some exotics are good nectar producers, but are not of sufficiently widespread distribution to be of more than local importance.

Clover and Other Sources

White clover (*Trifolium repens*) is an introduced perennial plant almost universally sown in pastures throughout the country. It blooms from November to late February according to locality and weather. Though it requires specific soil conditions and temperatures before yielding nectar freely, these optimum conditions occur with sufficient frequency to make it one of the most important of all honey sources both here and in countries overseas. White clover honey is mild flavoured, with a delicate aroma and is white. To many people it presents a standard by which all other honeys are judged.

Red clover (*Trifolium pratense*) and **crimson clover** (*Trifolium incarnatum*) are not used to the same extent as white clover, but they are sown extensively in many areas. These clovers with their brilliant red and crimson flower heads are most distinctive in appearance and though not favoured by the bees to the same extent as white clover, they do at times produce excellent crops of honey similar in quality, flavour, and colour to that of white clover. Both bloom from January to February.

The trefoils (*Lotus uliginosus* (*major*) and *Lotus angustissimus*) are good honey plants yielding nectar in fair quantity in late spring and early summer. The honey is of excellent flavour and a bright, light amber. The cappings of *Lotus* honey are noticeable for the distinctive yellow appearance.

Buttercup (*Ranunculus* spp.) is a plant of widespread distribution throughout New Zealand. There are several species, most of which favour moist pastures and low-lying, uncultivated areas. The deep green serrated leaves and bright yellow flowers create a striking effect on heavily infested areas. These are

[*Douglas Elliott*

Rewa rewa, the native honeysuckle, at times produces a very heavy flow of nectar, but like the pohutukawa it is not a consistent yielder, though there is not usually a complete failure as often occurs with pohutukawa.

valuable honey plants, producing a medium amber honey of pleasant flavour from October to December. The honey blends well with others and has good body characteristics.

Dandelion (*Taraxacum officinale*) is a perennial herb common to both islands and found in pastures and waste places. It sometimes exhibits extraordinary vigour of growth in

Buttercup is a valuable source of honey, producing a medium amber honey of pleasant flavour which blends well with other honeys and has good body characteristics.

Scotch thistle, when plentiful, is an excellent source of a white, mild flavoured honey.

damp situations where the ground is rich. The bright yellow flowers are borne mainly from October to December, though some persist throughout the year. The honey is mild flavoured, a light amber, and blends well.

Scotch thistle (*Cirsium lanceolatum*) is a common weed favouring cultivated lands of both main islands and flowering mostly from January to March. When plentiful it is an excellent source of a white, mild flavoured honey.

Pennyroyal (*Mentha pulegium*) is a low-growing perennial weed common to both main islands. It is found both in pastures and waste places, but prefers damp, sour soils. The leaves are short stalked and up to ⅜in. long. The flowers, in varying shades of blue, are crowded in bunches surrounding the stem at intervals. Pennyroyal flowers from December to March, but the main nectar secretion period is January and February. The plant carries a distinctive aromatic odour which can be detected easily in the

Pennyroyal honey has a most marked flavour which makes it unpopular to many people for table use unless it is blended with honeys of milder flavour.

Blackberry yields nectar freely and where it is abundant may provide good crops of honey with a mild, delicate flavour resembling that of clover honey.

honey. The honey is fine grained, medium amber, and has a most marked flavour which makes it unpopular to many for table use unless blended with honeys of milder flavour.

Blackberry (*Rubus fruticosus*) is common to locally abundant in the wetter areas of both islands, and though it is found throughout the drier areas, it is generally localised. It is a noxious weed and in the more settled areas is being gradually eliminated through the widespread use of hormone sprays. The plants flower from November to January, bearing numerous blossoms from pink to white. Blackberries yield nectar freely and where they are abundant may provide good crops of honey. The honey is water white with a mild delicate flavour resembling that of clover honey. When granulated it has a dull, waxy appearance. It is often confused with clover honey.

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Lilies are Popular Flowers

THOUGH lilies have been admired for centuries, their popularity seems to have increased lately, perhaps because great interest is being taken in hybridising and new forms and colour combinations of the old types are being developed. Many lilies are not difficult to grow. In this article, K. H. Marcussen, Horticulturist, Department of Agriculture, Christchurch, discusses their requirements and suitability for use in the home garden; routine gardening work for April is also dealt with.

LILIES are often considered difficult to grow. That is really not so, especially if a knowledge of their habitats is acquired. Who, for example, would grow alpine plants in a shady bog or bog plants on a hillside?

Lilies are found growing in many different localities and under very varied conditions, all under temperate climates, from bogs in North America to mountain slopes of the Far East. Some will therefore be suitable for growing in one part of New Zealand and others will grow much more luxuriantly elsewhere. There are, however, quite a range of hardy lilies which can be grown satisfactorily in most places without specialised knowledge and those are the ones considered in this article.

Many plants (such as arum lilies, belladonna lilies, and lily of the valley) are called lilies, but botanically are not true lilies, which are recognised as being plants of the genus *Lilium*. Though some 300 to 400 species of lilies have been described, today fewer than 100 are considered as species, but many varieties and hybrid crosses from these exist.

General Requirements

Many theories about lily culture have been put forward, but general practice has shown that many lilies can be grown under ordinary garden conditions and that they should not be coddled or forced with rich soil or fertilisers. The most important factor is good drainage, which is absolutely essential even for lilies growing naturally under bog conditions. The plants like an abundance of moisture during the growing period, but after flowering too much water round the bulbs is harmful and will encourage basal rot, a fungous disease.

The soil need not be rich, but should contain plenty of humus. It should be deeply cultivated before planting, preferably by double digging without the subsoil being brought to the surface. If the addition of organic material to the soil is considered necessary, the best material is leafmould or half-rotted leaves, as that will improve the soil in general without enriching it too much. Rich compost or animal manure should be used only sparingly and if the soil is considered to lack fertility, a dressing of bonedust is safest.

Few lilies like an alkaline soil and not many will tolerate very acid conditions. A neutral to slightly acid soil is probably the most suitable and lime should be applied to lilies only after very careful consideration.

Generally varieties that are most suitable for the particular soil and climate should be chosen.

Adequate moisture during the growing season (summer) and a good supply of humus will assist in giving lilies a cool root run. Most lilies will grow quite satisfactorily in the open provided the roots are not baked by the sun. To make conditions most suitable lilies can be underplanted with suitable bedding plants, or they can be planted in the herbaceous border where perennials will shade them at ground level. They can also be grown among low shrubs as long as these do not have a vigorous root system, which would be detrimental to the welfare of the lilies.

HEADING PHOTOGRAPH: Massed display of *Lilium regale*. News-Photo Service photo.

← *Lilium tigrinum.*

If no other ground cover can be provided, a mulch should be applied during summer. Sawdust has been found satisfactory, but when it is applied a dressing of blood and bone should also be given to counteract possible nitrogen deficiency.

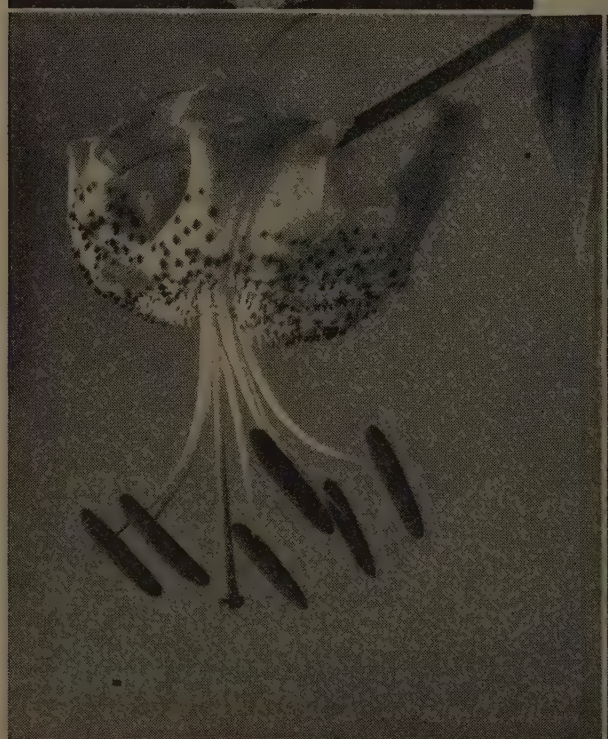
Though most lilies will develop quite satisfactorily in full sun, it is often an advantage to grow them in light shade. A position where they can grow in the part shade of trees, but far enough away not to be affected by the tree roots, is ideal for most lilies. The flowers will generally last longer than in the open and the colours will not fade.

The roots of lilies should not be disturbed. Lilies are never dormant like most other bulbs and transplanting should be carried out only when really necessary. The plants themselves and the size of the flower heads will indicate if transplanting is required. Large clumps give a magnificent display.

A position for lilies should be prepared well in advance of planting. Deep cultivation is required, but after the ground has been dug over to a depth of 18in. it should be allowed to settle naturally. Lily roots are soft and fleshy and any movement of the soil would be harmful.

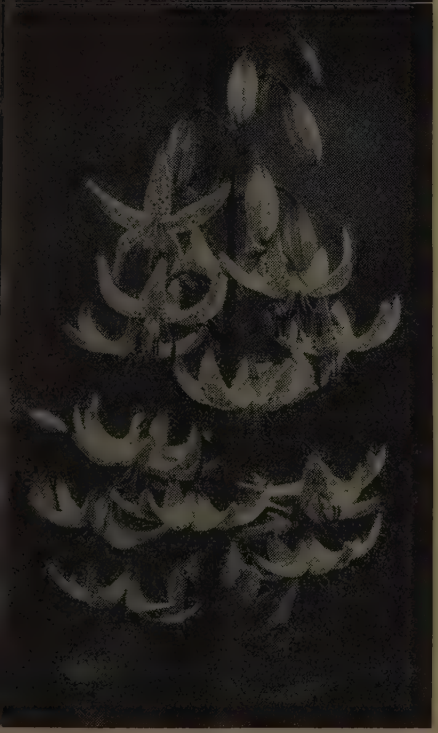
The greatest dormancy of lilies occurs soon after flowering, when the leaves and flower stalks are drying off, but some species, for example, the Madonna lily (*L. candidum*), will develop new shoots in about a month after the flower stalks have died. Lifting is therefore best done as soon as the stalks are dry. If it is not possible to replant immediately, they should be packed carefully in damp material such as sphagnum moss to keep the roots alive.

When lilies are transplanted within the garden the depth at which the bulbs were growing should be noted



Lilium speciosum (left) and *Lilium auratum* Crimson Queen (right).

← *Lilium formosanum.*



← *Lilium* Mrs. R. D. Backhouse

so that they can be replanted at the same level, but smaller bulbs should never be planted as deeply as large ones. In heavy soils planting should not be as deep as in sandy soils.

Lily bulbs have some means of adjusting their position in the soil. Those that require to grow fairly deep have two kinds of roots. From the base some stronger and thicker ones will develop and if necessary they will shorten and gradually pull the bulb down to the correct level. These contractile roots can be seen in the illustration at right on page 297.

Apart from the roots growing from the basal plate some species are stem rooting. They form another set of feeding roots at the base of the shoots just above the bulb. These roots are only annual ones and die when the flower stalks dry off after flowering. Stem-rooting lilies should be planted deeper than those forming only basal roots, but they seldom need to be covered by more than 6in. of soil.

L. candidum and *L. chalcedonicum* should be covered by only an inch or two of soil and *L. giganteum* (now classified as *Cardiocrinum giganteum*) should have the tops of the bulbs protruding.

Lily bulbs that have been brought in should be planted at the earliest opportunity.

The placing of sand round lily bulbs when planting is sometimes recommended. If drainage is good and the sand very coarse, this practice may be satisfactory, but really is not necessary and can be dangerous. If drainage under the bulb is not very good, the sand may act as a drainage pit for surrounding soil and create a pocket of water, which would be detrimental to the bulb.

Dusting of bulbs before planting with a thiram-based dust to prevent fungous diseases is a good practice.

Lilies look best if planted in groups or drifts. They then become part of the landscape and they can be given proper attention more readily, especially in preparation of the site before planting.

Maintenance and Pests and Diseases

Lilies do not require much attention after planting. Where late frosts are expected in spring some protection may be necessary for the early species.

Snails and slugs can be very damaging to young, tender shoots and must be guarded against. A bait containing metaldehyde is very effective and can be made up by mixing 1oz. of metaldehyde powder with 2½lb. of bran moistened with molasses. Small heaps of the bait should be placed near the lilies in the evening and replaced regularly.

Rabbits can also play havoc with the new shoots of lilies. If they are troublesome and the garden is inadequately fenced, special protection should be given by placing wire netting round the lilies.

When the shoots have become well established in spring a dressing of bonedust and sulphate of potash at 2oz. and ½oz. respectively per square yard, or a dressing of old farmyard manure or compost, will be beneficial, but no fresh manure should be applied.

Taller species must be staked, but care should be taken when the stakes are put in that the bulbs are not damaged. In windy situations regular tying in should be done as the shoots elongate.

Aphides should be controlled as soon as they are seen. Apart from the damage they may cause to the tissue they transmit virus diseases from plant to plant. Aphides can be controlled by applying nicotine sulphate at 1 fl. oz. plus 2oz. of soft soap to 4 gallons of water or HETP at ½ fl. oz. to 4 gallons of water. Sprays should be repeated at 10-day intervals until the plants are free from aphides.

Virus diseases are not uncommon on lilies and infected plants will always constitute a danger to other plants. Virus infection may show up in the leaves as striping, mottling, or distortion. The flowers may be malformed and not open properly; sometimes striping and unnatural blotches appear on the petals. The plants will generally look unhealthy and dwarfed.

There is no cure for virus and infected bulbs should be destroyed, as they will always remain a menace to healthy ones.

Grey mould, *Botrytis cinerea*, may infect lilies. It is a fungous disease affecting leaves, stems, and flowers and it is generally most prevalent after cold and wet weather, especially where air circulation round the plants is poor. The first symptom is usually the appearance of brown spots on the leaves. If conditions favour development of the fungus and no control measures are applied, all the foliage may become infected and wither and the flowers will seldom open. A grey mould will later appear on the affected parts.

At the first sign of infection a thiram spray should be applied at 1½oz. of a 50 per cent. preparation to 4 gallons of water. Spraying should be repeated at 2-weekly intervals.

Photographs on this page and the opposite page by Douglas Elliott.

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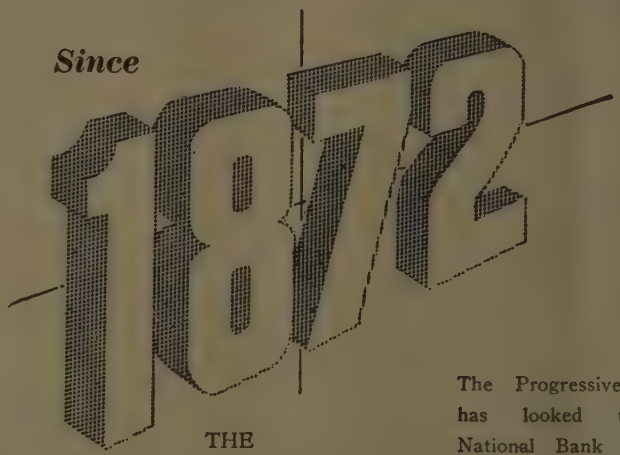

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If lilies have been badly infected with grey mould, the stems should be cut off close to the bulbs soon after flowering, carefully removed, and burnt to prevent spread of the disease; otherwise the flower stems should be allowed to dry naturally before being removed.

Propagation

Lilies will multiply naturally by the bulbs splitting up or by new ones forming alongside the old ones. On some species small bulbils will also develop at the base of the stems after flowering and a few species, for example, *L. sargentiae, sulphureum,* and *tigrinum,* will develop bulbils in the leaf axils on the flower stalks.

[*Photo News*

Lilies will multiply naturally by the bulbs splitting up or by new ones forming alongside the old ones.

[*Photo News*

The new shoots of the Madonna lily appear about a month to 6 weeks after the flower stem dies down. It is too late then to move or split up a clump.

The smaller bulbils should be planted out in a reserved area where they can be given adequate care. Aerial bulbils should be collected before they drop and planted in sandy loam until roots have formed, when they can be planted out with the other bulbils.

If a greater increase in stock is required, two other methods of vegetative propagation can be employed:—

1. Immediately after flowering the stems should be removed close to the bulbs. After the old flower heads have been cut off the stems should be heeled in shallowly to three-quarters of their length and kept moderately moist. Many varieties will then develop bulbils on the lower ends of their stems and by autumn they should be lifted and grown on as described above.

2. Scales can be detached from healthy bulbs and planted a couple of inches deep in sandy soil. After a month or two small bulbils will have formed at the bases of the scales; these can then be detached and grown on. The best time for taking the scales is immediately after flowering. Scales should always be dusted with a thiram dust to prevent infection with fungous diseases.

Growing from Seed

If virus is present in bulbs, it will always be transmitted through vegetative propagation and lily growers therefore prefer to grow new bulbs from seed. Virus is not considered to be carried on seed and the assurance that the new bulbs are free from virus makes the growing of plants from seed worth while. To obtain bulbs of flowering size takes longer, but a greater quantity can be raised with little more effort. Many enthusiasts hand fertilise the flowers, making crosses of different varieties or species, which of course results in much greater interest in the seedlings.

Best and quickest germination of lily seed occurs when the seed is sown as soon as it is ripe. The seed pods should be collected as soon as they have turned brown and should be placed in boxes in an airy position for drying. A good soil mixture that has been sterilised should be used; the John Innes seed compost, which consists of the following ingredients, has been found very satisfactory:—

2 parts of turfy loam

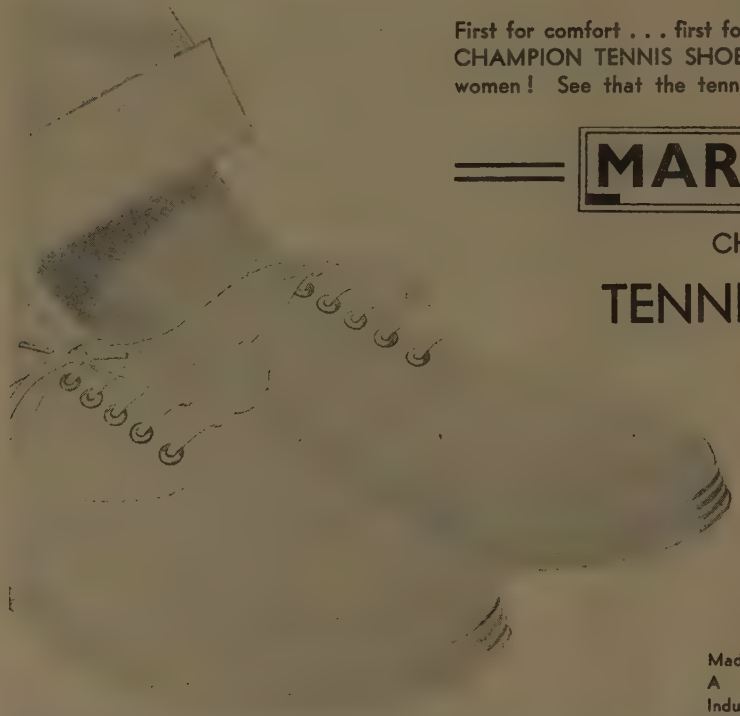
1 part of peat or leafmould

1 part of coarse sand

1½oz. of superphosphate and ¾oz. of lime per bushel of the mixture (an apple case contains approximately 1 bushel)

Sowing can be done in boxes or in a seed-bed prepared with this compost, either in a frame or outside. When lilies are raised from seed in the open it is advisable to cover the seed-bed with cloches to protect it from unfavourable weather and pests; slugs especially can be destructive to young seedlings.

The seed should be lightly covered. Very coarse sand has been found most



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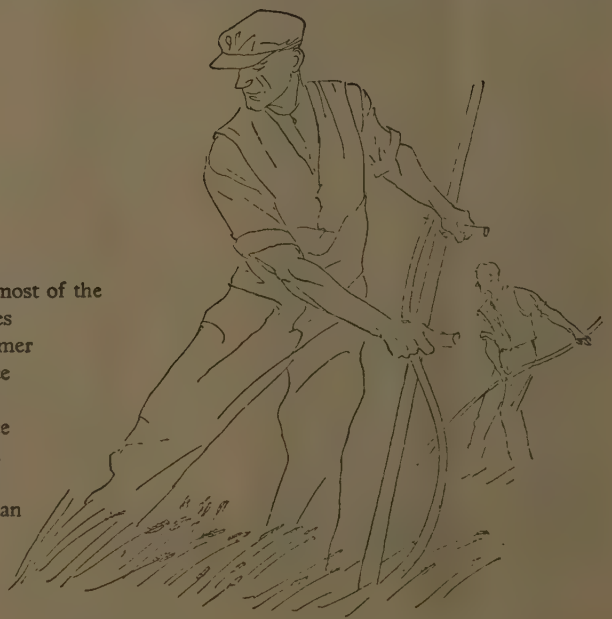

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suitable. If soil is used, it tends to cake and green algae and moss will develop more readily.

The time for germination varies greatly. Some species, for example *L. formosanum, longiflorum, philippinense, regale,* and *sargentiae,* may show the seed leaf in a few weeks. Other species may not germinate until the next spring, when the seed leaves will appear; in this group are *L. chalcedonicum* and *henryi.*

Some lily seedlings do not develop the seed leaf above ground as is normal with other plants. Instead this leaf will grow into a tiny bulb and later the true leaves will grow from this bulb.

If the seed is sown early enough in autumn while the ground is still warm, germination of the seeds will begin and may result in top growth the following spring. If the seed is not sown until late autumn or spring, top growth will generally not appear until a year later. In this group is *L. auratum.*

Seedlings can be transplanted from the seed-box or seed-bed when the first true leaves have appeared. In the home garden they should be lined out in a position where they can be given adequate care. The soil should be improved by incorporation of leaf-mould or some old farmyard manure or compost. Clay soils can be improved by addition of sharp sand.

Lily roots should be handled with great care at all times because they are never dormant. Larger bulbs will overcome damage, but on seedlings it may result in the death of the plant.

Some species may flower the first year after sowing, but others will take 4 to 5 years. The time required to reach flowering size can to some extent be judged by the period taken for germination.

The same attention should be given to small developing plants as has been recommended for flowering bulbs. It is especially important to ensure that virus is not transmitted to them.

Some Popular Varieties

In the following section some of the commonly grown species are discussed and details are given of their habits to enable home gardeners to make the best use of them. Special comments are made on the suitability of certain ones for growing under alkaline conditions.

L. auratum, the golden-rayed lily of Japan, is one of the most outstanding of the lilies. The large and fragrant flowers are white, golden streaked, and crimson spotted. There are many varieties and forms of this lily and many hybrids have been developed. One of the best known of the auratums is *L. auratum* Crimson Queen, a cross

[*Photo News*

▲ A plant of *Lilium henryi,* a typical stem-rooting lily, showing the thick, contractile roots formed below the bulb to pull it down to the required level and a mass of fibrous feeding roots growing from the stems above the bulb.

[*Douglas Elliott*

← Lilies look attractive when planted in groups among other plants.

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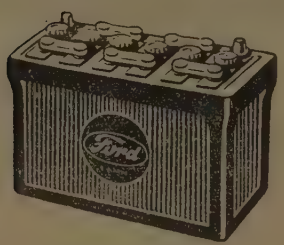

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Display by the New Zealand Lily Society at a Christchurch show.

between *L. auratum* and *L. speciosum*. The stems are from 3ft. to 5ft. high. Auratum lilies should be bought from a reliable source to ensure that the bulbs are free from virus. Very large bulbs seldom prove best; medium, firm bulbs are generally superior. Though they are not very particular as to soil type, they will not tolerate lime. They flower fairly late in the season.

L. candidum is probably the oldest of the cultivated lilies. It is known by many names, perhaps best as the Madonna lily. The pure white, trumpet-shaped flowers are on 4ft. to 6ft. stems. This lily flowers early in the season and is very hardy. New leaves will be produced soon after flowering, and transplanting when necessary should be done as soon as the flower stems have died. An acid soil does not suit it and it prefers an open situation. Unfortunately, this lily is very subject to botrytis and is frequently found infected with virus.

L. formosanum is often confused with *L. philippinense* and probably many lilies named as the latter are *L. formosanum*. It is a long, white, trumpet lily; the common varieties grow 4ft. to 6ft. high, but a dwarf, alpine variety seldom grows more than 1ft. *L. formosanum* is a very easy lily to grow from seed; it will sometimes flower the first year if seed is sown as soon as it is mature. As the bulbs deteriorate after some years, yearling bulbs only should be purchased. If bulbs are infected with virus, the symptoms will show very quickly and such bulbs are useless, but as the lily can be propagated readily from seed, virus infection need not be a deterrent to growing it. *L. formosanum* is a sun lover and should never be planted in dense shade.

L. hansoni belongs to the martagon group. The flowers are orange with brown spots and are borne on stems 3ft. to 5ft. high. It is hardy and not often affected by diseases. Furthermore, it will tolerate more alkaline conditions than will many lilies.

L. henryi is sometimes wrongly called the tiger lily or orange speciosum. The flowers are yellow-orange, of medium size, and are carried on 6ft. to 8ft. stems. It flowers fairly late in the season. If the flowers are exposed to full sun, they will bleach; a semi-shaded position is ideal. *L. henryi* will tolerate lime.

L. longiflorum is the white trumpet lily used by florists throughout the year in Europe and America. In New Zealand it is one of the lilies called the Christmas lily. Because it is used so extensively overseas, many varieties and forms have been developed. It is very easy to raise from seed and flowers very early in its life. This lily is rather subject to disease and if a good type has been obtained, it should be perpetuated by seedlings. It prefers a neutral to alkaline soil; it does not grow satisfactorily in shade.

L. martagon has given its name to a group of lilies. The small flowers, which are Turk's-cap shape, are waxy and a dull purple; there may be up to 50 on stems 5ft. or 6ft. high, but such fine specimens should not often be expected. The martagon lily is a European lily which has been cultivated for many years. There are a number of varieties and many forms; the best is the white-flowered variety *L. martagon album*. Among the many hybrids that have arisen from *L. martagon* are the Backhouse hybrids, which resulted from crosses with *L. hansoni*.

L. pumilum, also known as *L. tenuifolium*, is a delightful small lily belonging to the martagon group. The flowers are scarlet and it generally grows about 18in. high. It should be grown in groups to create effect and

is useful in a rock garden. The bulbs are small and short lived, but plants are easily raised from seed and will flower the first or second year from sowing.

L. regale is of comparatively recent introduction, having been found in China in 1903. It has become one of the most popular lilies, perhaps because it is extremely hardy and easy to raise from seed. The trumpet flowers are mainly white with rose-purple on the outside of the petals. The stems grow 4ft. to 5ft. high and may carry more than 20 large flowers. It thrives in hot, sunny positions, as can be seen in the illustration on page 291 and will tolerate lime. In southern districts it is generally in flower for Christmas.

L. speciosum strongly rivals the auratums in popularity. The flowers are smaller, but perhaps more dainty. There are many varieties and forms in shades of pink and red and also a pure white, all of which are good. They are among the latest-flowering lilies. Stems are generally 3ft. to 5ft. high. Though speciosums are more tolerant to lime than auratums, they do not grow satisfactorily in alkaline soils.

L. tigrinum, the tiger lily, is one of the oldest cultivated lilies. The flowers are orange-red spotted with purple; the stems are usually 4ft. to 5ft. high. The dark purple bulbils carried in the leaf axils are characteristic of this lily. There are a number of different varieties and forms, one of which is double flowered. The tiger lily is very hardy, but unfortunately subject to both virus and botrytis infections.

Advanced Lily Culture

To deal with any particular species of lily is beyond the scope of this article. There are many good books available on lilies and keen growers in this country have united to form lily societies, where discussions and shows are held.

Flower Garden in April

Much of the work in the flower garden during April will have a bearing on the display next spring. In many districts sowing and planting of bedding plants now will not result in flowering plants during winter, but because the soil is still warm, hardy plants are able to become established and though they will not grow much during the colder months, a colourful garden can be ensured in spring.

Gladiolus should be lifted as soon as the leaves are losing their green colour and dried thoroughly before being placed in storage. By this time of year it is quite safe to put them out in the sun for drying, but they should be brought under cover before evening.

Planting of bulbs for spring display should be completed without delay.

Beds and borders should be kept cultivated to kill any weed seedlings that may germinate, and if the soil is open, better growth of plants will develop and rain will be able to soak in. This could still be important if the next month or two should be dry.

Bedding Plants

In the milder districts many of the hardy annuals can be sown where they are to flower. With plants grown at this time of year results are often better if the roots are not disturbed through transplanting and many subjects seem to do better if sown where they are to flower.

Seed should be sown fairly thinly and as the seedlings develop they should be thinned gradually so that the distance between plants at flowering is 8in. to 9in. If they are left to grow too close together, the plants will be weak and spindly and have inferior flowers. Such plants will also be much more likely to suffer through adverse weather. Among subjects for sowing now are clarkia, cornflower, godetia, larkspur, nigella, and viscaria.

Seedlings that can be planted out now include antirrhinums, forget-me-nots, pansies, *Primula malacoides*, polyanthus, stocks, violas, and wallflowers. Canterbury bells, carnations, and sweet williams can be planted for a display in early summer.

Border Plants

Many of the herbaceous perennials will have finished flowering by the end of this month and should be cut back almost to ground level. This will keep the border tidy until all flowering is completed and the border can be overhauled.

In many districts frost may kill dahlia tops during April. If this happens, the plants should be cut off some 4in. to 6in. from the ground.

Evergreen perennials and rock plants should be tidied up and checked over before winter. Sometimes the soil may have come away from the roots during hosing and cultivation, and topdressing with soil may be necessary.

Plants such as aubretia, aquilegia, and lupins can be planted now and will provide a good display early next season.

Lawns

Sowing of new lawns can still be carried out in northern districts, though it is getting rather late.

Old lawns may be renovated at this time of year. First any flat weeds should be lifted out with a knife or cut well below ground level. The grass should be cut as close as possible, clippings being removed in a catcher. The whole lawn should next be thoroughly raked with a strong rake to remove any material lodged among the grasses and also runners of weeds and moss. The lawn should then be mowed again and if necessary this operation should be repeated several times. If so, it is best to work in different directions to remove as much as possible with the raking.

If the lawn has become very compacted, which may be caused by traffic or through poor drainage, some aeration of the turf and soil may be necessary. This is best done by a special turf corer, which when pressed into the soil removes small cores. However, in home gardens this operation can be performed quite satisfactorily by forcing a fork into the ground so that holes are left at 3in. to 4in. intervals. Filling of the holes with soil is seldom necessary.

Any weak areas or bare spots on a lawn should be lightly forked up and sown. An uneven lawn can be levelled off gradually by spreading a topdressing of soil over the depressions. This topdressing should not be more than ¼in. thick at any one time or the grasses may not push through.

Finally a topdressing of fertiliser containing 3 parts by weight of sulphate of ammonia and 1 part of superphosphate should be applied at 1oz. of the mixture per square yard.

Cuttings

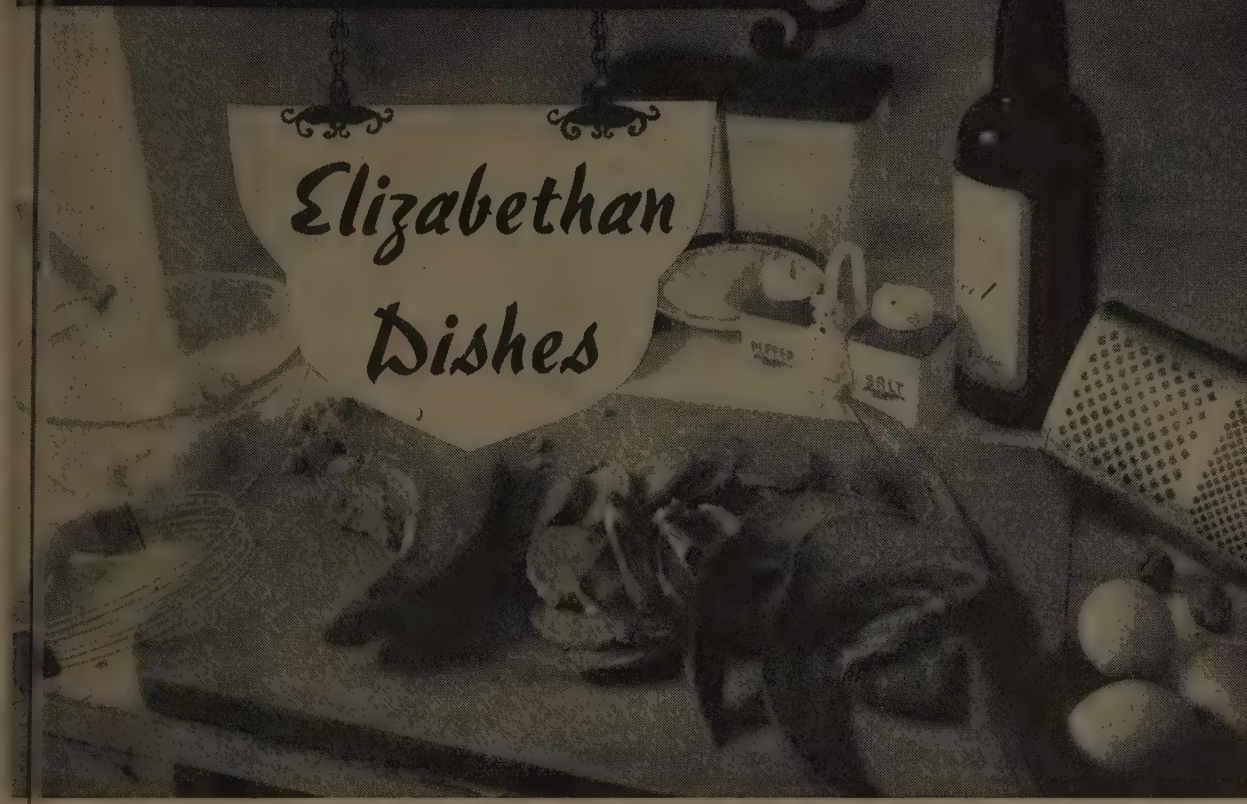
Many deciduous trees and shrubs can still be raised from hardwood cuttings as described last month. These include abelia, berberis, buddleia, hydrangea, poplar, privet, spindle tree, spiraea, tamarisk, and willow.

Where a frame is available cuttings of many herbaceous perennials such as arabis, carnation, gazania, nepeta, and geranium can be raised.

Addition of Organic Matter

Flower gardens are seldom supplied with sufficient organic matter, which is a very important ingredient of the soil, as it improves the texture and both drainage and water-holding capacity. All these factors assist plant growth.

At this time of the year, when leaves are falling and much garden rubbish accumulates, all suitable organic matter should be collected and either composted or saved and dug into the soil just before winter. No plant material infected with disease or the roots and seed heads of perennial weeds should be saved, but should be burnt to prevent spread of diseases and weeds.



By DAPHNE EILERS,
Field Officer in Rural Sociology, Department of Agriculture, Auckland

DURING the centuries food habits have varied according to the general prosperity of the period. During the Elizabethan Age the English nobleman lived well. Though his house was not always comfortable by our standards, his food was of the best. The table that a man kept gave a fairly accurate indication of his wealth and position. To the Elizabethan eating was an art and as such it had its own formal rules and discipline. In general only two meals a day were eaten, the nobility dining at 11 and supping at 5, while the merchants' meal hours were usually noon and 6 o'clock. Breakfast was not generally eaten except by "hungry young stomachs that cannot wait for dinner"!

THE ritual accompanying the preparation of the table for the meal and the service of the food to the diners was most elaborate. The Gentleman Usher of the household was in charge of proceedings and he and the Yeoman Usher supervised the placing of the damask cloth and the setting down of utensils. At each place was put a trencher, a roll of bread, a knife, and a spoon. Though forks had been introduced into England, they were not greatly used, it being thought that fingers were quite adequate. For this reason it was the custom for finger bowls to be passed for diners to rinse their hands before beginning the meal. This custom has persisted in some countries and finger bowls are sometimes passed round at a formal dinner, though the fork has long since replaced the fingers.

Dining Ritual

When all was ready and the diners assembled the food was brought from the kitchen by a retinue of servants, everyone remaining standing until the main meats were placed on the table. The various dishes, of which there might be as many as 12 to 16 different kinds, were then presented to each of the guests in order of rank.

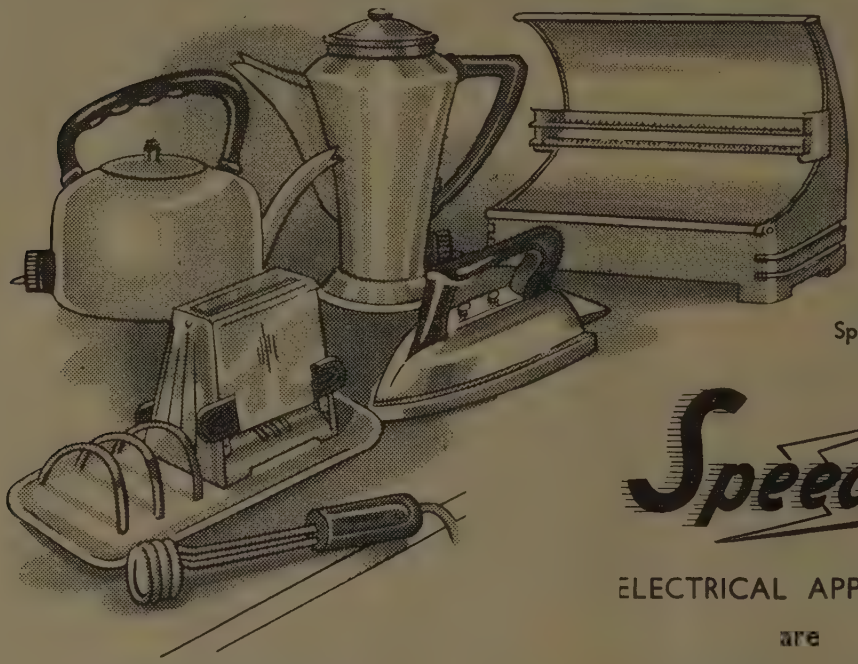
Everyone except the very poorest ate great quantities of meat of all kinds: Beef, mutton, lamb, veal, pork, kid, rabbit, capon, and venison, as well as fish and wild fowl and imported foodstuffs. Meat was roasted on turnspits by the open fire, pans being placed underneath to catch the drippings from the meat (hence the present name of dripping for fat). The meats were served with a great variety of piquant sauces. Though many vegetables were known, they were not popular. Potatoes were introduced during this period, but bread was still preferred to them.

A great number of herbs were grown for culinary uses as well as for medical potions. They included aniseed, angelica, borage, fennel, saffron, mustard, sage, thyme, tarragon, mint, and parsley. Spices were also used in the majority of recipes, pepper, cloves, ginger, and mace being very popular. Honey was also much used and was sometimes poured over the hot meat before it was served.

The Elizabethan liked his sweets too and there were always a tremendous number of jellies, custards, cakes, and sweetmeats served. Savoury and sweet pies were popular and their fillings were many and varied, meats, fruits, and flowers such as primroses and marigolds being used. Flowers were used in salads too, violet buds being favoured!

Beer, ale, cider, and imported wines of many varieties were drunk at meal

▲ Ingredients for neat's tongue pie.



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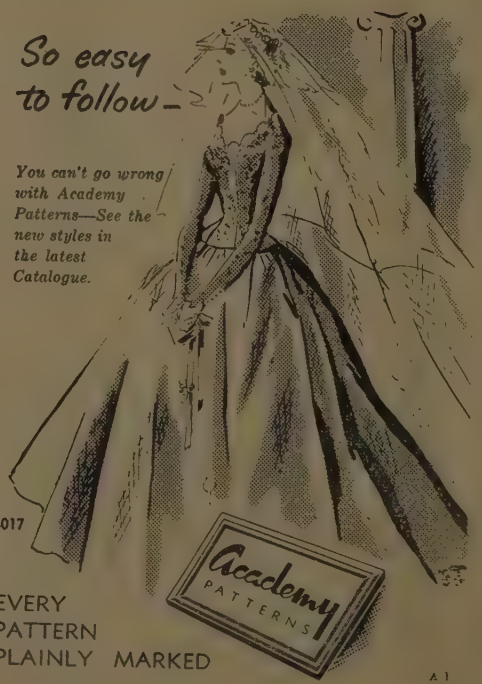

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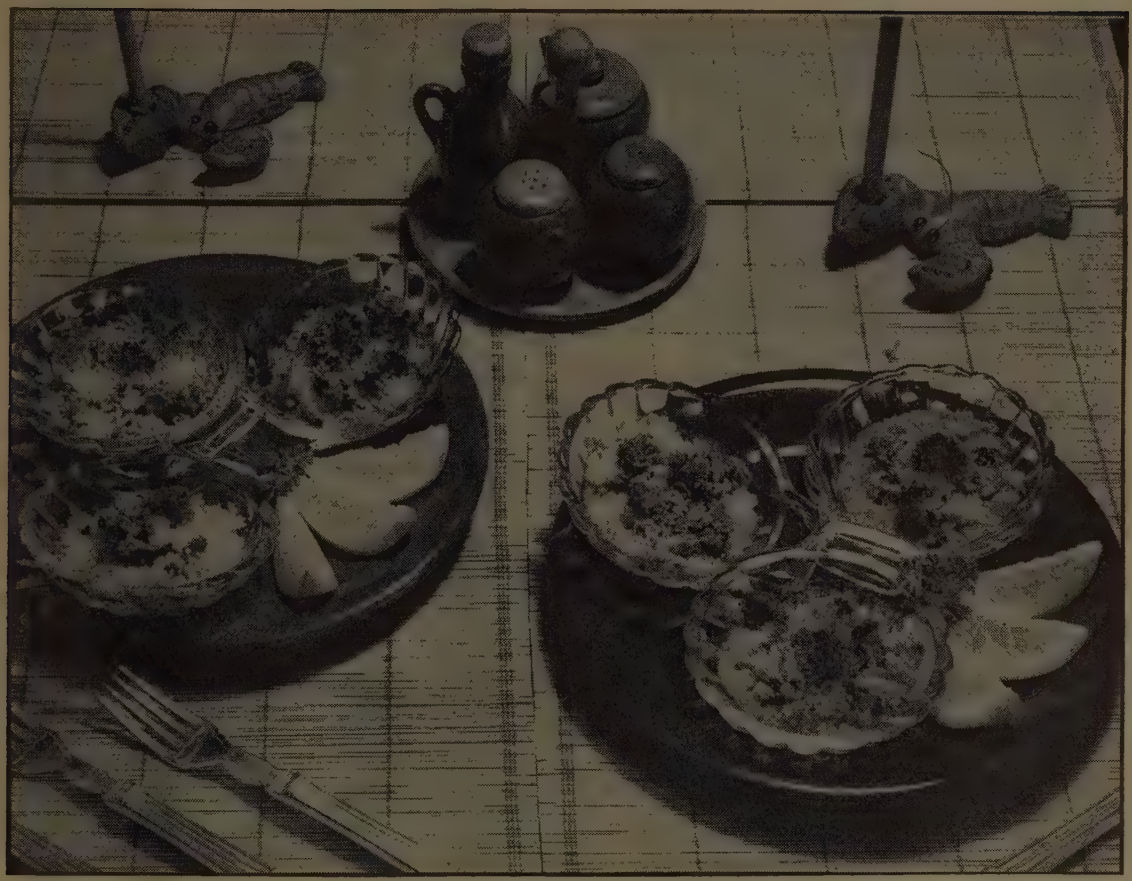


Baked oysters in individual dishes. Oysters thus prepared are very appetising.

times. They were also used in cooking, as in this recipe for a "simple jelly", taken from "England in Tudor Times" by L. F. Salzman: "Take two calves' feet and a shoulder of veale, and sette it upon the fyre in a fayre potte wyth a gallon of water and a gallon of claret wyne, then lette it boyle till it be jellye, and then take it up and drayne it and putte thereto synamon, ginger and suger and a lyttle turnesole to coloure it after youre dyscrecion."

When the guests had eaten the remaining food was sent back to the kitchen, where the upper servants and officers of the household had their share. The third group to eat from the remnants of the meal were the serving men and the waiters. Finally the poor waiting round the gates were given what was left.

It is staggering to imagine the amount of food which would be prepared for every meal for a household of this type, where upward of 60 people were fed. It is interesting, too, to contemplate the costs involved. In London, at the end of the 16th century, costs per pound were: Sugar, 1s.; kitchen sugar, 10d.; ginger, 4s.; cloves, 6s. 6d.; cinnamon, 4s. 6d.; raisins, 3½d.; currants, 9d.; and rice, 4d. To give an equivalent in modern money these figures must be multiplied by ten.

Savoury Recipes

Many of the recipes used in those days would no longer appeal to popular taste even if all the ingredients were available. However, it is interesting to try some of the simpler ones and to adapt some to present-day use.

Oyster Pie

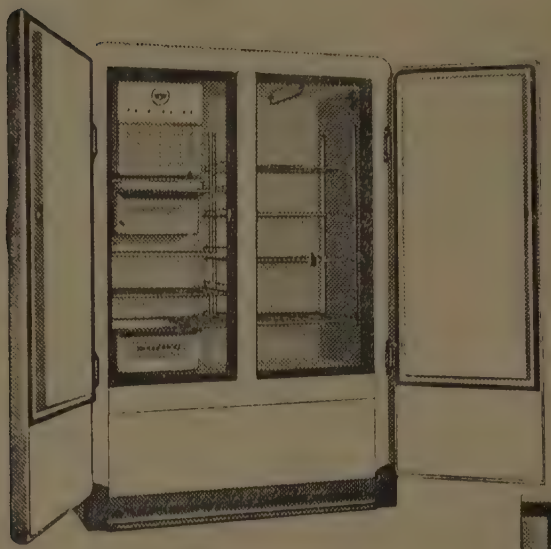
1 quart of oysters
¼lb. of butter
2 teaspoons of anchovy sauce
2 tablespoons of breadcrumbs
Pepper to taste
¾ teaspoon of grated nutmeg
1lb. of short crust pastry
1 lemon
1 tablespoon of chopped parsley

Mix the butter, anchovy sauce, breadcrumbs, parsley, and spices to a paste. Line the bottom of a pie-dish with pastry and spread half the butter mixture on top. Place the prepared oysters on this butter layer. On top of them put the rest of the butter. Pour over this a little of the oyster liquor and two teaspoons of lemon juice, then cover all with the rest of the pastry. Bake the pie in a moderate oven until the pastry is browned. Serve it with lemon juice.

Baked Oysters

1 tablespoon of butter
1 pint of oysters
1oz. of butter
Breadcrumbs (soft)
Pepper and salt
1 tablespoon of chopped chives
A few mushrooms (if desired)
1 tablespoon of chopped parsley

Heat the butter in a pan and saute the parsley, chives, and mushrooms in this. Add the oysters and seasonings and pour into individual serving



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dishes. Sprinkle breadcrumbs on top and dot with pieces of butter. Brown in a quick oven and serve with lemon pieces.

Devilled Trout

1 trout	2 shallots (chopped)
1oz. of butter	1 small onion
1 tablespoon of chopped parsley	1 leek
1 tablespoon of chopped chives	1 carrot
Clove of garlic (chopped)	3 cloves
	Red and white wine
	Salt and pepper to taste

After cleaning and scaling the fish place inside it a mixture made with the herbs and butter. Place the fish in a pan with the prepared leek, carrot, and onion stuck with the cloves. Over this pour ¼ cup of red wine and ⅜ cup of white wine and a cup of water. Simmer the fish until it is tender. Lift out the fish and place it on a warmed plate. Remove the vegetables and thicken the liquid to serve as a sauce with the fish.

Marzipan: Fruit shapes, simple sweets, and crystallised fruit.

Neat's Tongue Pie

("Neat" is an old English name for "ox")

1 ox tongue or 2 calves' tongues	1lb. of flaky pastry
½lb. of raisins	3 egg yolks
Pepper and salt	2oz. of butter
Nutmeg	A little claret wine

Simmer the ox tongue until it is tender (about 3 hours). Peel the tongue and slice it thinly. Line a baking dish with half the pastry and place the tongue and raisins in layers on top of the pastry. Season these with pepper and salt and a little grated nutmeg. Cut 1oz. of the butter into pieces and place these on top of the tongue. Cover the tongue with the rest of the pastry and bake the pie in a hot oven until it is golden brown (450 degrees F. for ½ hour).

Make a sauce by melting the remaining ounce of butter and stirring in the 3 egg yolks. Add to this gradually ¼ cup of claret wine and heat the mixture gently until it thickens. Care should be taken not to overheat it, as curdling will result.

If desired, the egg and butter may be added to the pie before it is baked and the claret omitted.

Ragout of Wild Pork

Shoulder of pork	Spray of rosemary
Bouquet garni (bay leaf, thyme, sage, and parsley)	Salt and pepper

Heat sufficient water almost to cover the pork. To this add pepper and salt and the herbs tied in a bag. Bring the mixture to the boil. Add the meat and boil it rapidly for 5 minutes. Lower the heat and cover the pan. Simmer the meat gently until it is tender (time allowed 20 to 25 minutes per pound). Remove the meat and reduce the cooking liquid which can then be thickened and used as a sauce. In addition to the herbs the Elizabethan cook added orange peel to the cooking water and white wine to the sauce.

Savoury Omelette (Kickshaw)

3 eggs	¼ teaspoon of ground ginger
½ teaspoon of salt	¼ cup of chopped, cooked liver and bacon
½ teaspoon of mixed spice	½oz. of butter
Pinch of pepper	
2 tablespoons of chopped spinach	

Beat the eggs and add the seasoning, spices, and spinach. Heat the butter in a heavy frying pan and put in the chopped liver and bacon. Pour the egg mixture over it and cook the omelette over gentle heat until the egg is browned underneath. Place the pan under the grill or in the top of the oven to set the top of the omelette lightly. Fold the omelette and serve at once.

Desserts

Almond Tart

1lb. of short pastry

Filling

2 eggs	3oz. of ground almonds
3oz. of sugar	½ cup of milk (approximately)
1 tablespoon of sugar	

Line a tart plate with the pastry. Prick the pastry well with a fork. Beat the eggs and sugar until the mixture is thick. Fold in the ground almonds and add sufficient milk to reduce the mixture to a thick cream. Pour it into the pastry-lined dish and bake the tart in a fairly hot oven (400 degrees F.) for 15 to 20 minutes. Just before the tart is cooked sprinkle it with 1 tablespoon of sugar and return it to the oven.

Candied Fruits

Though expensive to buy, candied fruits are still very popular. They are not difficult to make, though the process is rather long.

The fruit should be firm and sufficiently ripe for the flavour to be well developed, but it should not be soft. Small fruit should be pricked with a silver fork and large fruit such as peaches and pears should be cut into quarters after being peeled.

The prepared fruit should be placed in sufficient boiling water to cover it and cooked gently until it is tender. The time required will vary with the fruit. If cooking is overdone, the texture will be spoilt, and if underdone, the product will be tough.

For every pound of fruit a syrup of ½ pint of the cooking water and 6oz. of sugar should be made. This is poured over the fruit, which is allowed to stand for 24 hours. At the end of this time the syrup is drained off the fruit, 2oz. of sugar are added to the syrup, the syrup is brought to boiling point, and is again poured over the fruit. The following day a further 2oz. of sugar are added to the syrup, the fruit is placed back in the syrup, and the whole brought to the boil and simmered gently until the fruit is clear. The fruit is lifted from the syrup and placed on absorbent paper, dusted with a little sugar, and allowed to dry either in the sun or in a very slow oven. If the fruit shows signs of stickiness, it should be sprinkled with a little more sugar.

When the fruit is easily handled and shows no sign of stickiness it should be stored between sheets of waxed paper in an airtight container.

Candied Flowers

Rose petals or violets are the most suitable flowers to candy. They make attractive decorations for cakes.

The flowers should be washed and dried with a cloth. Heat 2 cups of sugar and 1 cup of water until the mixture boils and continue boiling it until it reaches the thread stage. Dip the flowers (on a wire thread) into the syrup, then dust them with sugar and dry them.

Marzipan

Marchpane (marzipan) was a favourite sweet. The following is an old recipe:—

Beat 2lb. of blanched and dried almonds in a stone mortar and mix them with 2lb. of sugar; add 2 or 3 spoonfuls of rose water. Roll the paste flat, lay it on wafers, bake it, and ice it with rose water and sugar; leave it in the oven until the icing dries and then "garnish with pretty conceits and birds and beasts being cast out of standing moulds. Stick long comfits upright in it, cast biscuit and carroways in it and so serve it; gild it before you serve it." ("Delights for Ladies", 1602.)

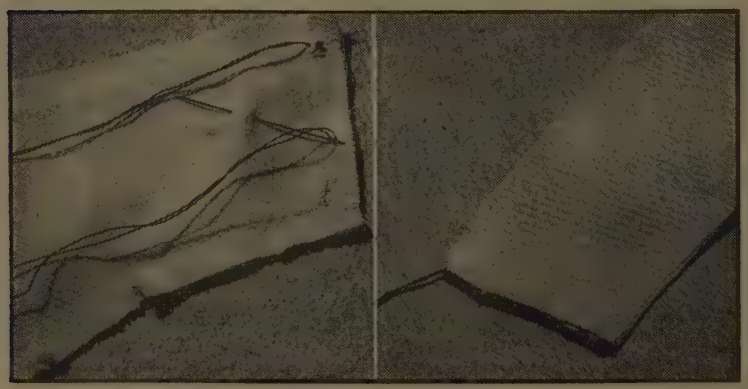
Today marzipan is used for coating rich fruit cakes before royal icing is applied. It can also be used for making animals or fruit shapes for cake decoration and as a base for simple sweets. Dates, prunes, or raisins stuffed with marzipan and rolled in castor sugar or coconut are delicious. A modern recipe for marzipan is given here.

½lb. of icing sugar	1 egg
½lb. of almonds	Lemon juice

Remove all lumps from the sugar by sieving it and mix it with the ground almonds. Beat the egg slightly, and with some of the lemon juice add it to the almond and sugar. Work the mixture to a soft, pliable dough. If it is too stiff, more lemon juice or egg may be added.

All photographs by Sparrow.

Method of Ensuring Trim, Taut Corners



Left—The thread has been knotted in the corner and the collar is ready to be turned right side out. Right—The collar has been turned right side out and the thread has been pulled taut at the corner ready for snipping off.

TRIM, taut corners to collars, cuffs, and lapels help to give garments a neat and professional appearance. The following is a simple way of achieving them.

After stitching the collar and before turning it to the right side thread a needle with double thread and knot it to the seam allowance as closely as possible to the line of stitching round the point of the collar. Turn the collar right side out and push the needle and thread to the right side exactly on the stitching line at the point of the collar. Draw the thread taut gently, and the result is a clean-cut corner. The collar can then be pressed and the thread snipped off.

—*EVELYN E. MOORE,*
Field Officer in Rural Sociology,
Department of Agriculture,
Palmerston North

Quickly Made Loose Cover Lampshade

By EVELYN E. MOORE,
Field Officer in Rural Sociology,
Department of Agriculture,
Palmerston North

A FREQUENT result of spring cleaning that includes, perhaps, the addition of new curtains, bedspreads, or freshly painted walls is that lampshades, though otherwise quite good, may seem rather dowdy or even no longer quite in keeping with the colour scheme. If the shade is of the Empire (illustrated), drum, pyramidal or oval shape, a loose cover in an attractive fabric, either to match or contrast with curtains, bedspreads, or other furnishings, can be simply and easily made in about an hour.

FIRM fabrics such as glazed chintzes, polished cottons, and taffetas are most suitable. If voiles, muslins, or other fine materials are used, they should be doubled to provide the necessary thickness of material to prevent glare from the bulb if the old shade is to be replaced or to prevent the old shade from showing through if it is retained. If the old shade is made of parchment with the frame consisting only of two rings, top and bottom, the parchment must not, of course, be removed, as it forms the necessary base for the cover. If the top and bottom rings of the frame are held apart by supporting wires, the old shade may be removed.

The amount of material to make a loose cover is not great, ½yd. of 36in.-wide material being sufficient for that illustrated.

As a guide, the material should be 2in. to 3in. longer than the depth of the frame and an inch wider than the circumference of the lower ring. Material 36in. wide is wide enough for a shade of average size, but for larger shades it is necessary to use either 48in. material or two strips of 36in. material joined together. Also required is about 1yd. to 1½yds. of fine strong elastic.

Making the Shade

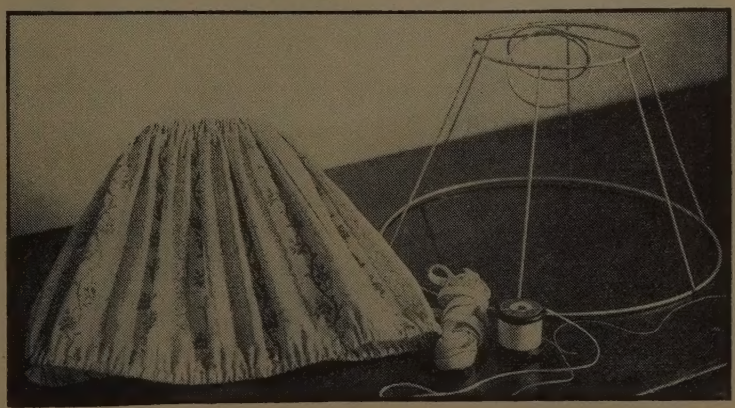
Measure off on the material the distance equal to the depth of the shade plus 3in. and check the width against the circumference of the bottom ring of the shade. If it is not wide enough, two strips of equal length will be required, and these should be joined with a flat fell seam. Measure the width accurately, adding on the seam allowance of 1in.

From this material cut out the strip required for the shade cover and machine the two edges together, again using a flat fell seam, to form a cylinder. Machine a hem about ½in. wide at the top and bottom of the cylinder, leaving a space for the insertion of elastic.

Insert elastic in the top hem, leaving the two ends loose in the meantime. Place the cover on the frame, pulling it down until it reaches about ½in. to ¾in. below the bottom of the frame. Pull up the two ends of the elastic, adjusting the gathers at the same time, until the cover fits firmly over the top of the frame and the inside edge is stretched in ½in. to ¾in. from the top edge of the frame. Mark the position for the join on the elastic, remove the cover from the frame, cut off the spare end of elastic, and join the two ends. Push them back into the hem, finish stitching the hem down, and adjust the gathers evenly.

Insert elastic in the bottom hem, again leaving the two ends loose. Put the cover back on the frame, and tighten the bottom elastic until the cover fits tautly over the frame.

Mark the position for joining the elastic, remove the cover, stitch the ends of the elastic together, finish the hem, press the cover if necessary, and place it back on the frame; the shade is then ready for more years of usefulness.



Vinegar — as Useful for Cleaning as for Cooking

By MARY HUNT,
Field Officer in Rural Sociology, Department of Agriculture, Christchurch

APART from the generally accepted uses, vinegar has a wide range of other uses, some of which are described below.

Cleaning

Washing Floors

A little vinegar added to the water used for washing floors softens the water and prevents a scum forming. This makes cleaning easier and the floors will be easier to polish.

Cleaning Windows

A little vinegar in the water used for cleaning windows will make the dirt come off the windows more easily and will also help to keep flies off the windows.

Removing Paint Marks from Windows

Dried paint marks can be removed from windows by rubbing them with a cloth soaked in hot vinegar.

Cleaning Brass Ash Trays

Burn marks can be instantly removed from brass ash trays by rubbing them with a cloth damped with vinegar. The trays can then be polished in the normal way.

Cooking

Boiling and Poaching Eggs

When eggs are being boiled a little vinegar added to the water will prevent the saucepan from being marked, and when eggs are poached will keep the whites firm.

A little vinegar added to the water in which eggs are boiled will prevent the saucepan from being marked, and in water used for poaching eggs will keep the whites firm. Burn marks can be removed quickly from brass ash trays by rubbing them with a cloth damped with vinegar.

Cake Icing

One teaspoon of vinegar (preferably white vinegar) beaten into boiled cake icing when the flavouring is added prevents the icing from becoming too brittle.

Fruit Jelly

The addition of ½ teaspoon of white vinegar when any fruit jelly is being made helps to make the jelly set more quickly and also gives it a pleasant tang.

Cooking Fish

When fish are being simmered add 1 tablespoon of vinegar to 2 quarts of water. The acid whitens the flesh and helps to keep it firm.

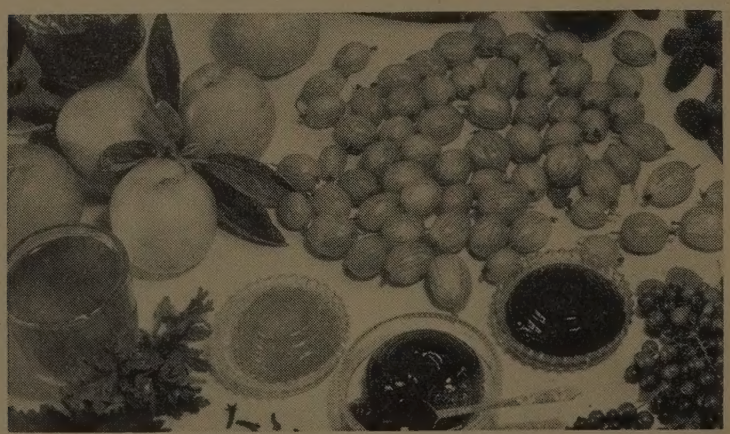
Cooking fish in vinegar (as in sousing) increases the food value, as the bones are softened and become edible. Thus calcium and other minerals are supplied to the body.

Making Sour Milk for Baking

Sour milk can be obtained by adding 1 tablespoon of vinegar to ½ cup of evaporated milk mixed with ½ cup of water. This can be used in such things as scones, cakes, gingerbread, or cookies. Sour milk made in this way gives a better texture, better flavour, and better keeping qualities to the scones or cakes.

Making Sour Cream

Sour cream can be obtained by adding 1 tablespoon of vinegar to 1 cup of undiluted evaporated milk. This can be used in recipes requiring sour cream, such as salad dressings, cakes, cookies, pie fillings, and vegetable sauces.



[*Sparrow*

Vinegar can be used to improve fruit jelly.

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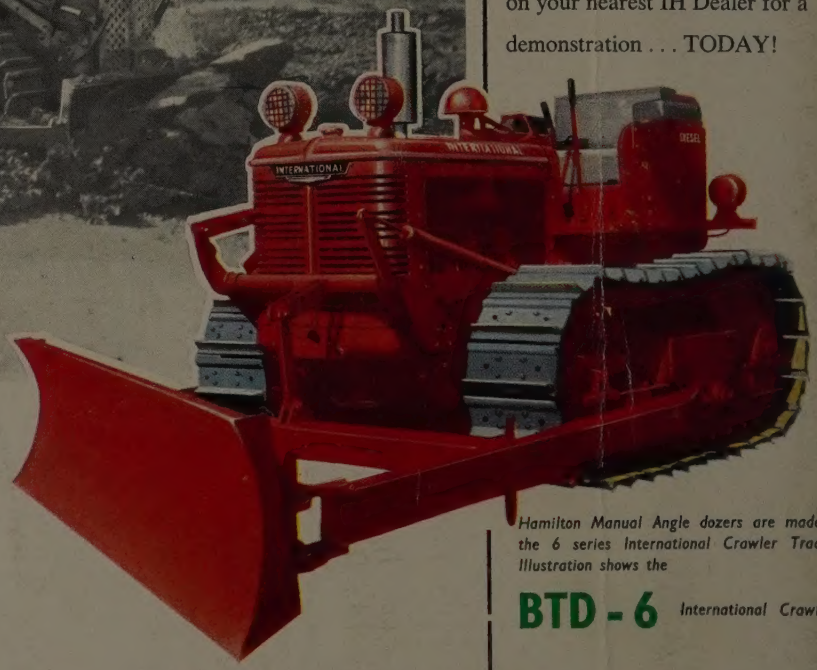

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